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NOVEMBER, 1958

PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

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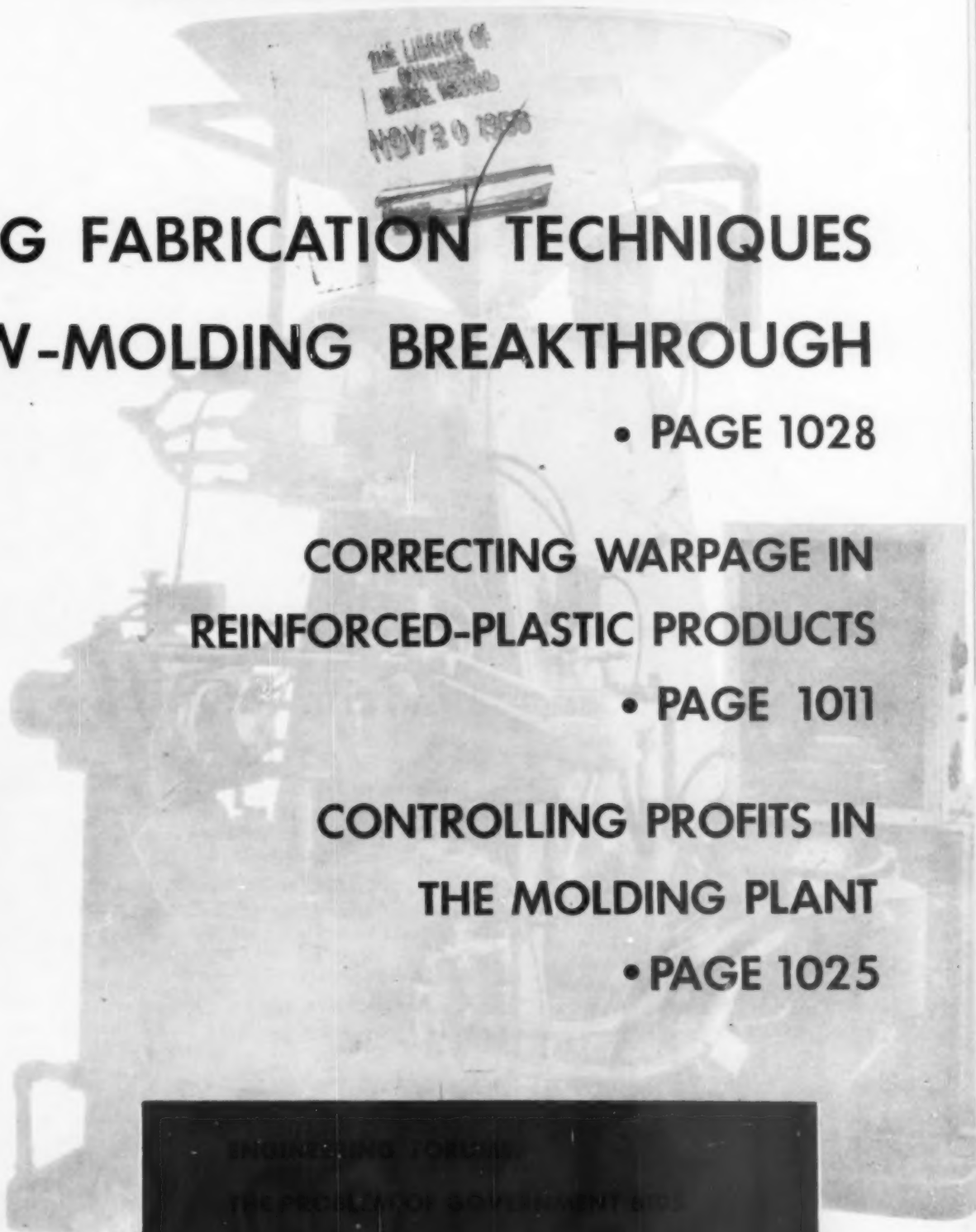

EXPLORING FABRICATION TECHNIQUES

BLOW-MOLDING BREAKTHROUGH

• PAGE 1028

CORRECTING WARPAGE IN REINFORCED-PLASTIC PRODUCTS

• PAGE 1011

CONTROLLING PROFITS IN THE MOLDING PLANT

• PAGE 1025

A BILL BROTHERS PUBLICATION

Your tooling resin formulator can help you

In an ever-widening range of production applications, tools and dies made with Epon resin-based formulations are giving outstanding service . . . and providing considerable savings compared to the cost of conventional tooling.

If you are concerned about the high cost of conventional tooling—your tooling resin formulator will show you how to get the most out of durable, impact-resistant Epon resin tools. His skill and knowledge, combined with Shell Chemical's years of experience and research, can mean more profitable production for *you*.

High-temperature tooling. Both metal and plastic forming tools, capable of operating at temperatures between 400°F. and 500°F., can be made with Epon 1310.

Long-lasting metal forming tools. Test results show that a casting of an Epon resin formulation mounted in a crank press and subjected to repeated blows had no permanent deformation after 28,000 cycles.

Excellent tolerances. Little machining and handwork are required to finish Epon resin tools, because the material can be fabricated to very close tolerances.

Outstanding strength. Tools with thin cross sections can be laminated with layers of glass cloth and Epon resin to achieve high flexural strength, and dimensional stability.

Can Epon resin help you with your tooling? Find out now by writing your tooling resin formulator. For a list of tooling resin formulators and further information on Epon resin, write to Shell Chemical.

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NOV 19 1958

If it has to be

flame retardant . . .

make it with

GREX*

HIGH DENSITY POLYETHYLENE

Flame Retardant Compound

The above photograph demonstrates the new flame retardant compound made of GREX high density polyethylene. Both of these samples have just been removed from thirty seconds of applied flame. Notice how the sample to the right continues to burn while the flame retardant GREX sample has immediately extinguished itself.

This new compound . . . available in ten different colors in two melt indices . . . opens the way for new and improved products never before possible with polyethylene. It is suggested for baby bottle warmers, television yokes, electrical connectors, electronic devices, air ducts . . . in brief, wherever flame retardance, strength and appearance are important.

Now, more than ever, *this versatile plastic means better products for you.*

**Trademark for W. R. Grace & Co.'s family of polyolefins.*

W.R. GRACE & CO.

POLYMER CHEMICALS DIVISION

OFFICES: CLIFTON, N. J. • CHICAGO, ILL. PLANT: BATON ROUGE, LA.

POLYMER GRACE CHEMICALS

GREX* in action

THE LIBRARY OF CONGRESS SERIAL RECORD
NOV 20 1958

tests . . . property changes . . . more flame tests . . . further property changes . . . the cycle repeats itself endlessly until finally perfection is attained . . . the first colored, flame retardant high density polyethylene.

Another significant advance in plastics has been achieved at the GREX modern Technical Service Laboratory at Clifton, New Jersey.

PERFECTING NEW TECHNIQUES

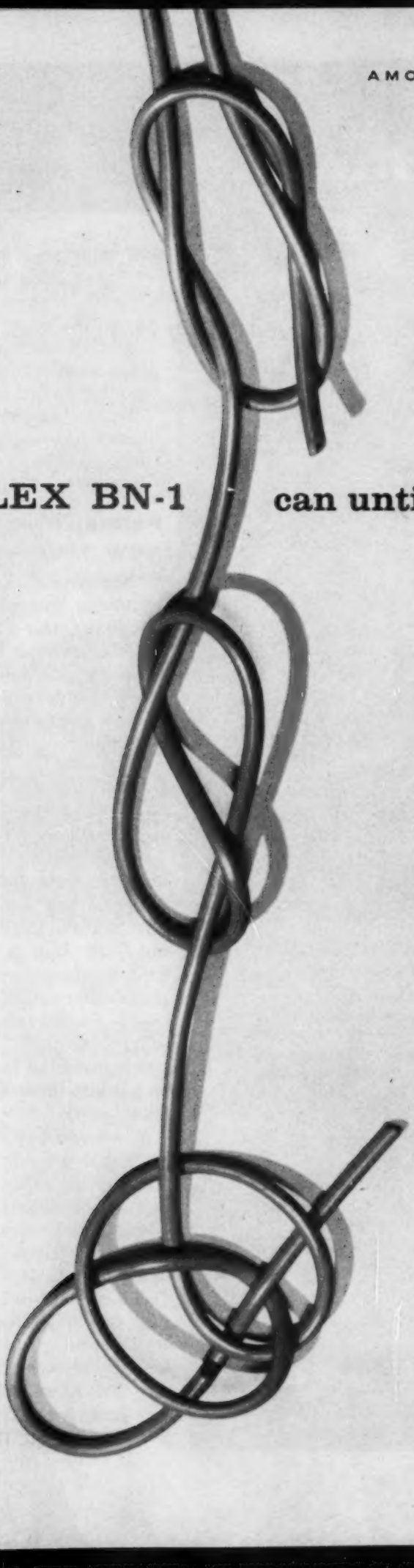
It was here that a dry coloring technique was perfected. It was here that the Pre-Compressed Molding process was successfully adapted to high density polyethylene in commercial applications . . . another step forward recently made available to the entire industry.

FURTHER ADVANCES

And it is here that further advances will be made . . . advances that ultimately mean better products and bigger profits for you. For Grace, in addition to undertaking pure research in behalf of improving GREX high density polyethylene, is also expressly geared to practical research. Conditions closely simulate those of your own individual plant. New developments perfected here are ready to be put into immediate use in your plant.

When you buy GREX, you buy more than a quality material . . . you buy the knowledge and foresight of our skilled technicians. It's often the difference between superior and average products. For further information on how our Technical Service Laboratory can help you in product and process development, write to W. R. Grace & Co., Polymer Chemicals Division, 225 Allwood Road, Clifton, New Jersey; or 3555 West Peterson Avenue, Chicago, Illinois.

AMOCO CHEMICALS—A NEW RESOURCE



PANAFLEX BN-1 can untie knotty vinyl extrusion cost problems

Are you making vinyl extrusions for low-cost applications—welting, tubing, hose—for either permanent or expendable uses? Perhaps PANAFLEX BN-1 can help you with your raw material cost problems.

PANAFLEX BN-1 is a hydrocarbon secondary plasticizer for vinyls. It is a clear, light straw-colored liquid, compatible with vinyl chloride polymers and copolymers. It formulates readily with primary plasticizers, pigments, stabilizers and other ingredients. Color stability and volatility compare favorably with other hydrocarbon-type plasticizers. Its specific gravity is only 0.946.

In large-volume compounding for extrusions, a few cents saved per pound of compound makes a big difference in profits. PANAFLEX BN-1 can help you widen your margin of profit by reducing your compound costs. You'll get a good-quality finished product plus, in some instances, improved processing.

Your request for further information will receive immediate attention.

AMOCO CHEMICALS

AMOCO CHEMICALS CORPORATION
910 South Michigan Ave., Chicago 80, Illinois

PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING

NOVEMBER 1958 VOLUME IV NUMBER 11

FEATURE ARTICLES:

1011 CORRECTING WARPAGE IN REINFORCED-PLASTIC PRODUCTS ..... *Thomas Harris*

Warpage can be corrected by easily-accomplished design changes in the molds, rather than by use of shrink rules.

1013 ULTRA-SONIC CLEANING OF PLASTIC SPECTACLE FRAMES ..... *Don May*

How one manufacturer, using ultrasonics, saves $5-10,000 annually in cleaning time, effort, and trouble.

1017 NOL RING TEST FOR GLASS ROVING-REINFORCED PLASTIC ..... *P. W. Erickson, Sr., I. Silver and H. A. Perry, Jr.*

A new test method is proposed, and flexural, tensile and sheer strength data are given for epoxy and polyester rings made with different finishes.

1025 CONTROLLING PROFITS IN THE MOLDING PLANT ... *D. A. Dearle*

How costs for materials, labor, and various forms of overhead affect total plant costs and in turn, molding profits.

GUEST EDITORIAL:

1016 MODERNIZATION ..... *N. W. Oberle*

ENGINEERING COLUMN

1028 EXPLORING FABRICATION TECHNIQUES ..... *L. J. Zukor*

1. Blow molding. 2. Plastic web control. 3. Preplasticizing unit.

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1030 REINFORCED PLASTICS ..... *Harry T. Douglas*

The problem of government bids.

1031 COMPRESSION & TRANSFER MOLDING ..... *Paul E. Fina*

The thermosetting molder and his friend, the end-user.

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1032 MOLDED URETHANE FOAM WITH VINYL SKIN

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Cover photo courtesy: U. S. Kautex Sales Corp.

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PUBLISHED MONTHLY BY

Plastics Technology Publishing Corp., a Division of

BILL BROTHERS PUBLICATIONS

BILL BROTHERS PUBLISHING CORPORATION

630 THIRD AVENUE, NEW YORK 17, N. Y.

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Previews of Next Month

The following articles will be published in the December issue:

Effect of Extrusion Conditions on Polyethylene Pipe. J. F. Morris, tech. service rep., Spencer Chemical Co., Kansas City, Mo.

•

Extrusion Theory. Drs. H. M. Hulburt, & Stanley Katz, both of American Cyanamid Co. and L. F. Street, Mgr. of Marketing, Welding Engineers, Inc., Norristown, Pa.

•

Silicone Aerosols as Mold Releases. A. R. Morse, Sales Engr., Injection Molders Supply Co., Cleveland, O.

•

Low-Temperature Grinding Reclaims Vinyl Scrap.

•

Guest Editorial: **"Polyethylene and Post Thermoforming,"** by Gerhard Kostrzewa, Consultant, Franklin Park, Ill.

•

Highlights of this Issue

Correcting Warpage in Reinforced-Plastic Products. (p. 1011)
By means of specific case histories, it is shown that warpage should be corrected during mold design, rather than by expensive shrink fixtures that do only part of the remedial job.

•

Ultra-Sonic Cleaning of Plastic Spectacle Frames. (p. 1013)
Ultra-sonic cleaning equipment is shown to save processing time and money, and also result in a better product.

•

NOL Ring Test for Glass Roving-Reinforced Plastics. (p. 1017)
A ring specimen is proposed that offers a triple approach to the evaluation of surface treatments on glass roving for use in reinforced plastics. Ring segments may be tested in flexure or shear, and the entire ring can be tested in tension or flexure. The ring also is adaptable to the measurement of damping coefficient. Test results are given, and test variables are discussed in detail.

•

Controlling Profits in the Molding Plant. (p. 1025)
The use of a form sheet is recommended to facilitate the checking of actual and estimated costs. Such comparison sheets are essential to efficient plant operation and also helps follow production costs, thus controlling profits.

Letters to the Editor

We Bow in Thanks

Dear Sir:

This letter is an appreciation for the many articles of interest and "facts" that we have read with profit in your magazine since its inception, particularly the column "Exploring Fabrication Techniques."

You may quote me if you so desire.

S. Zimmerman, Pres.
Merit Creations, Inc.
Mamaroneck, N. Y.

• • •

Thanks Our Engineering Editor

Dear Mr. Zukor:

I am in receipt of your letter of September 22, and should indeed like to thank you for your very interesting and detailed reply to my queries of September 4th in connection with your recent article.

I should like to say how much I appreciate your attention and the trouble you have obviously taken in order to let us have as much information as possible, which has certainly proved most helpful.

G. Frey, Director
Industrial Plastics Ltd.
London, England

• • •

Bag Molding vs. Hand Lay-up

Dear Sir:

We are manufacturers of Construction Equipment Cabs, Special Truck Cabs, Hoods, Fenders, Grilles, and Hot Water Heaters, etc.

There is a trend in this industry, as in many others, to use glass filled polyester resin materials to fabricate the parts we make. Our production is such that we feel hand layup of these parts too costly, and not large enough to justify the matching steel dies in a press type of manufacturing.

I have heard somewhere of a bag-molding process of "fibre glass" parts. Can you tell me where I might get publications, books, etc., explaining this process.

R. R. Schwedler, Prod. Mgr.
Chicago Mfg. Co.
Chicago, Ill.

(In his reply, Lee Zukor, our Engineering Editor, mentioned two books on glass-reinforced plastics that would be of value to Mr. Schwedler, and also the opinion by Harry Douglas, vice-pres. of Lunn Laminates and a member of our Editorial Advisory Board, that bag molding would not offer any advantages in time, labor, or other costs over the hand lay-up method.—Editor)

• • •

SPI Moldmakers Publications

Dear Sir:

In the September issue, there is an article on "Mold Making & Tooling," edited by Ernest J. Csaszar, in which Mr. Csaszar states that you have a list of publications available, and he goes on to itemize them from 1-9. We are interested in obtaining these data sheets, and would you please advise how they may be obtained.

G. M. Zook
Kiddie Brush & Toy Co.
Jonesville, Mich.

(As Mr. Csaszar stated in his column, the Society of the Plastics Industry has compiled the nine publications in general or suggested form so that individual users can adapt them to their own particular activities. Copies of the publications, therefore, should be requested directly from SPI.—Editor)

• • •

Information Wanted

Dear Sir:

We would like to locate the manufacturer of plastic legs that can be used in furniture manufacture.

If you know of such a source, we would greatly appreciate getting their names so that we could contact them.

R. H. Laramie, Industries Supt.
Graystone Industries
St. Cloud, Minn.

(Any replies received here will be forwarded directly to the inquirer.—Editor)

We invite letters from our readers for publication in these columns. Such letters may be of comment or critism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation and address.

A letter will not be printed if publication is not desired by the sender, and the identity of the writer will be withheld, if desired.

—The Editor

"Quote . . . Unquote"

Need for Scientific Literacy

"With some outstanding exceptions, there is evidence that scientific illiteracy is fairly widespread in business and industry. American industry is spending about $7 billion a year on research and development. But until recently only a very small percentage of this was spent on true fundamental research.

"We have tried too hard to sell science as a way of curing our bodily ills or of bettering our creature comforts. We have failed to explain science as a great adventure and great achievements of the human mind and spirit. We have committed this failure for a number of diverse reasons. One is the false concept of scientific security. Another is probably due to the fact that so much science now is a team effort and it is difficult to give proper credit for achievements. Another is the quite proper reluctance on the part of companies to reveal valuable secrets in a highly competitive business environment. Still another is that science today is increasingly complex and difficult to explain to the untrained mind.

"Despite these obstacles, our times demand that we cut through them and do a concentrated, expert job of beating down public illiteracy about this subject.

"Modern science is having, and will continue to have, profound effects on civilization and human life. It is so much a factor that we cannot afford to let the understanding of it rest in the minds of a highly trained few. I doubt that many American scientists hope to control their fellow men by keeping this understanding to themselves. But too much of the understanding is confined to them by default. They have an obligation to inform others much more than they have. But at the same time, I think any citizen who is willing to undertake broad responsibility is equally obligated to become as informed on science as he can.

"With the best systems of communication in the world, and with our highly intelligent citizenry, I am certain that this nation's scientific literacy will become more than adequate. When it does, this nation's leadership in science will be unsurpassed. There will then be no shortage of qualified scientists, because bright youngsters will see the opportunities for some of the greatest adventure and achievement life can afford.

"The frontiers of today and of tomorrow are in the field of science. If the youth of our country are properly trained today, a hundred years from now people will be looking back to our way of life as one of hardship and privation."

Gen. J. E. Hull, USA (Ret.), Pres. Manufacturing Chemists' Assn., Inc. Washington, D. C.

hr

Industry usage* endorses

PLENCO HEAT RESISTING PHENOLIC COMPOUND 349

FOR APPLIANCE handles, knobs and trim that must have the highest possible heat resistance, molders recommend and leading manufacturers specify Plenco 349 HR. because:

- It possesses a heat resistant range up to 500°F.
- Offers superior surface finish, smoothness and lustre that adds to the beauty and saleability of the appliance.
- Provides efficient production due to the fast cure and excellent mold release characteristics of the material.
- Assures dependability: To the molder because of its uniformity—to the end user because of its molded characteristics.

*We estimate that (since its introduction in 1952) eighty to one-hundred million parts have been molded from Plenco 349 HR. . . . and for many of the best-known names in the appliance industry.

Investigate the good reputation of this excellent material; it will serve you well.

PLENCO PHENOLICS FOR BETTER PLASTIC PRODUCTS

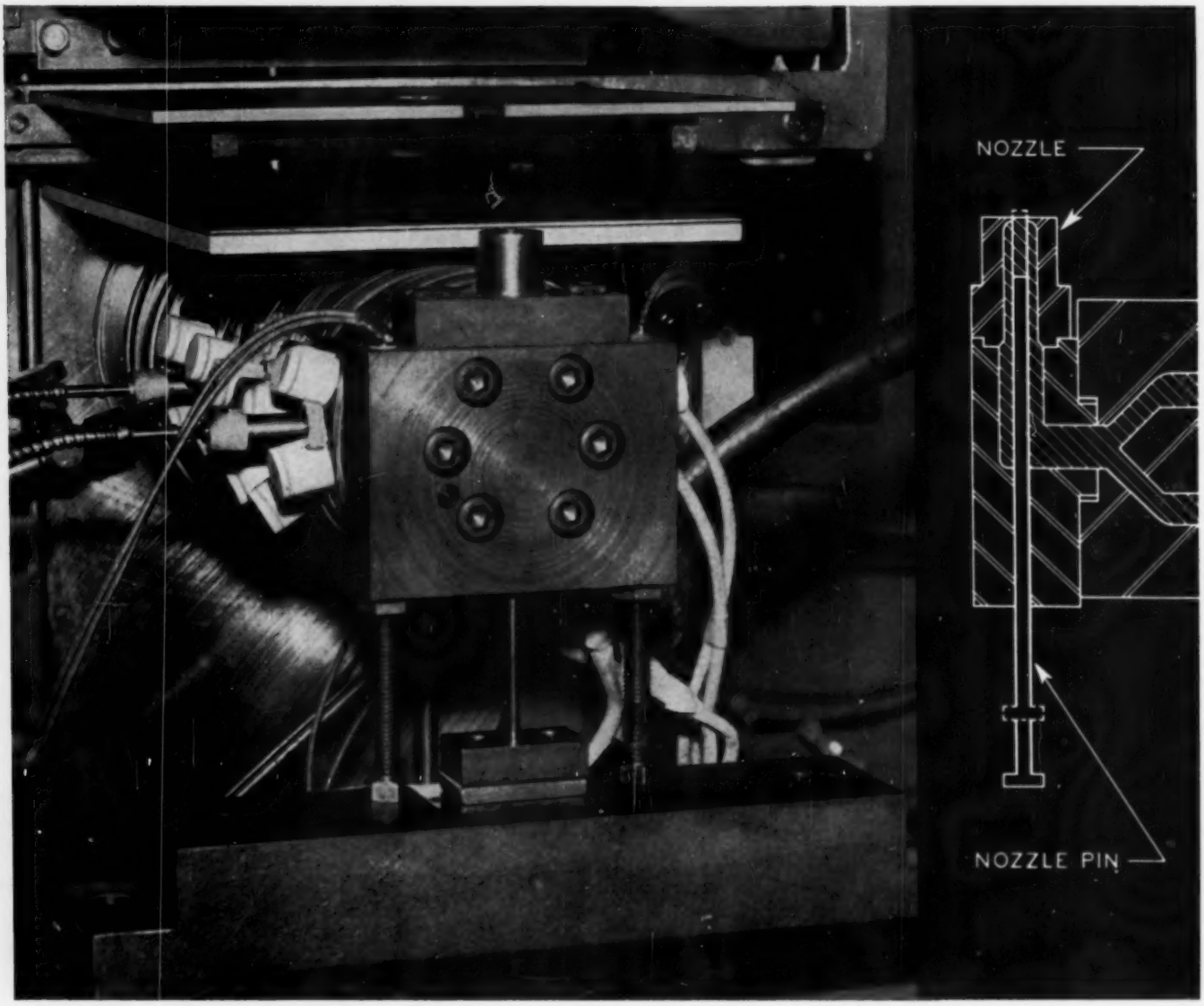
IF PHENOLICS CAN DO IT—

plenco

CAN PROVIDE IT...
already-made or specially-made

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.



STOKES *exclusive* nozzle shut-off... for precompressed injection molding!

Here are five important reasons why this exclusive Stokes feature increases the efficiency of injection molding:

- Provides precompressed material in the heating cylinder
- Decreases pressure loss between injection ram and nozzle
- Increases plasticizing capacity
- Provides faster filling of cavities
- Completely eliminates nozzle "drool" and "strings"

This exclusive feature is typical of the unique Stokes injection molding concept. Do you have all the facts on *positive ejection* and *truly automatic molding?* Write, today.

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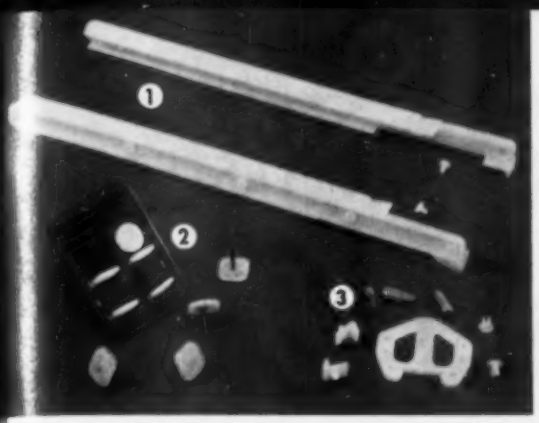
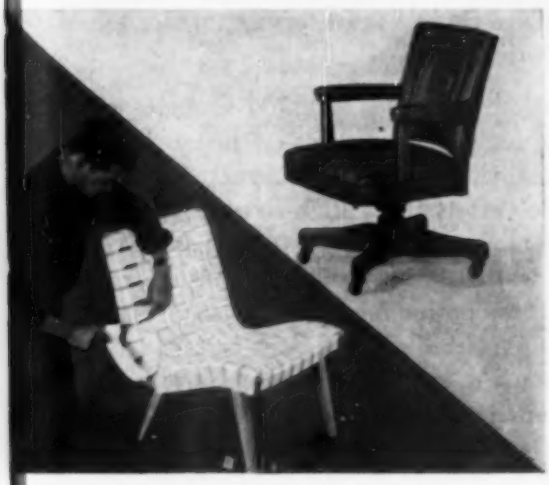


New MARLEX furniture components include: (1) drawer glides and bearings molded by Prolon Div., Pro-phy-lac-tic Brush Co., Florence, Mass. (2) "Floormate" furniture glides, made by Childlore Corp., Kansas City, Mo., and (3) self-lubricating center drawer guides, glides and dowel pins molded by Reiss Mfg. Co., Little Falls, N. J.

MARLEX filaments are woven into attractive long-wearing upholstery and drapery fabrics such as the material on this office chair (below right), as well as durable, weather-proof furniture webbing like this popular "do-it-yourself" material woven by Thomas Taylor & Sons for Webcraft, Inc., Bridgeport 6, Conn., who developed this new market.



American Seating Company, world's largest manufacturers of school and other public seating, selected MARLEX rigid high-density polyethylene for the Amerflex® seat and back of this new desk-chair unit . . . molded by Michigan Panelyte Division of St. Regis Paper Co. MARLEX seating components are as functional as they are attractive—with built-in colors, snag-proof washable surfaces and integrally molded connections.

Modern furniture uses MARLEX*

. . . to reduce costs of key components

More and more furniture manufacturers are switching from wood to plastic components molded from MARLEX. These new components have no joints to come unglued . . . they are dimensionally stable—won't absorb moisture to cause warping and sticking. Furthermore, MARLEX components have smooth snag-proof surfaces, with molded-in colors, that are easy to clean and maintain and never need refinishing . . . and they are tough, durable and can be molded to any shape.

MARLEX is impervious to cleaners, shampoos, polishes, waxes or moth-proofing compounds—and is unaffected by temperatures from —180° to 250° F. MARLEX components are non-rusting, non-staining and self-lubricating. They can be injection molded, vacuum-formed, extruded or cast and machined. *They cost much less than comparable nylon or reinforced polyester components.* In fact, no other type of material can serve so well and so economically in so many different furniture applications. Write to your nearest MARLEX sales office for further information.

*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma
A subsidiary of Phillips Petroleum Company

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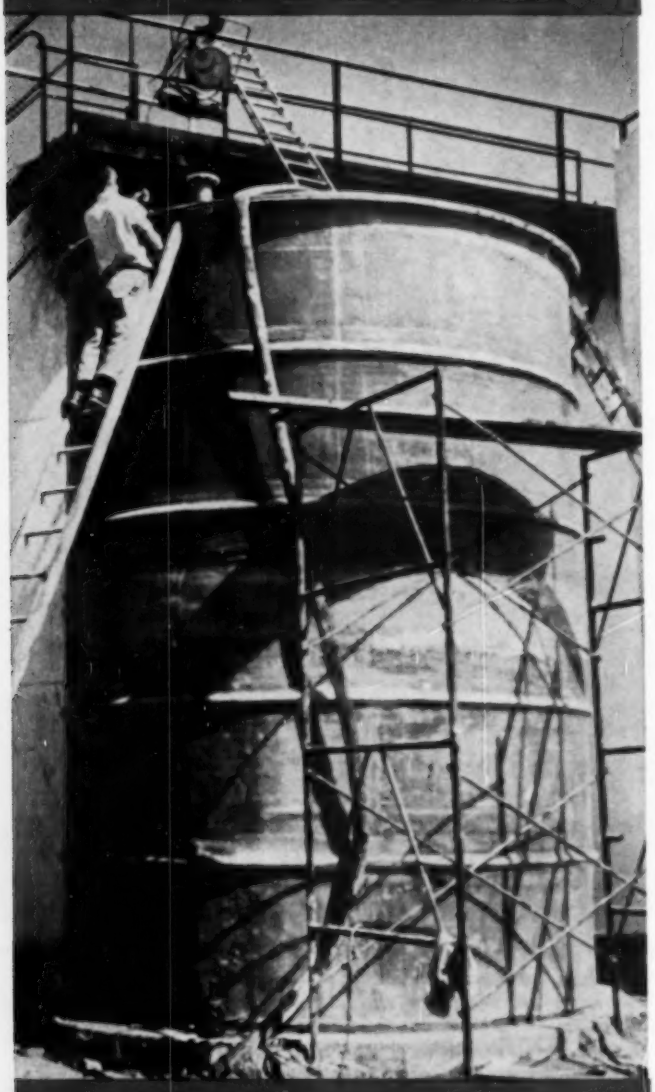
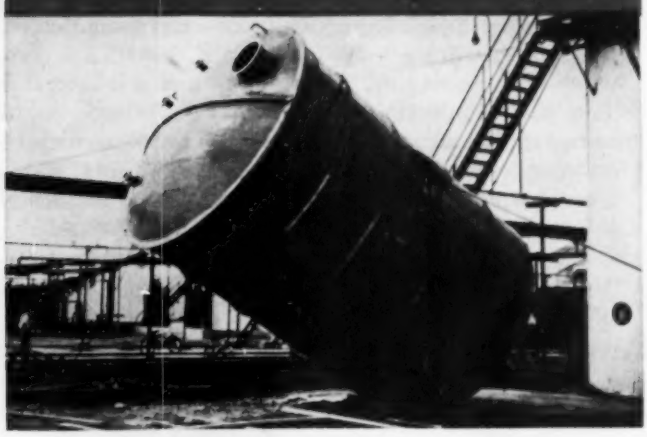
MARLEX

TANK MADE WITH ATLAC® 382 POLYESTER



LIGHT ENOUGH FOR HAND RIGGING, 12,000-gallon Haveg tank was installed in only 8 hours by two men . . . cost several thousand dollars less than conventional corrosion-resistant tanks. ▼



still OK after 2 years storing HCl

Corrosion-resisting assignments don't come much tougher than that filled by the storage tank shown here. Made by Haveg Industries, Inc., of Wilmington, Delaware using ATLAC 382 polyester resin, it has already racked up two years service for storing 37% hydrochloric acid.

Superior resistance to acids, alkalies and detergents, even at high temperatures, is just one of the *different* qualities you get with ATLAC 382 . . . the *different* polyester. It's a high-strength, lightweight material that stays strong after exposure to steam or hot water. It keeps its high insulation resistance and low power factor at elevated temperatures. It's free from styrene odor or taste. In molding compounds, it carries fibers uniformly to edges, at corners and in deep draws.

ATLAC 382 comes in dry form for pre-pregs or for your own mixing, and in convenient new liquid form. Write today for complete data and samples.

CHEMICALS DIVISION
ATLAS POWDER COMPANY
WILMINGTON 99, DELAWARE
In Canada: Atlas Powder Company, Ltd.
Brantford, Ontario, Canada

Note: you can get the unusual qualities of ATLAC 382 in ready-to-mold form with our THERMAFLOW® reinforced molding compounds based on this *different* polyester.

U.S.I.

Vol. III No. 5

POLYETHYLENE PROCESSING TIPS

HOW TO MINIMIZE NECK-IN IN EXTRUSION COATING AND FLAT-FILM CASTING

Extrusion coaters and film makers working with polyethylene are frequently faced with the costly and bothersome problem of "neck-in" during draw-down of the hot melt web between the die and the nip or casting roll.

It is accompanied by "beading," or thickening of the melt at both edges of the coating or cast web. As the roll is wound up, the weight of the coated sheet or film is supported by the two beads. This results in a soft roll, sagging in the middle, or in possible breaks in the taut edges of the substrate. Excessive neck-in means trimming the edges of the sheet, with a considerable loss of usable web width and material.

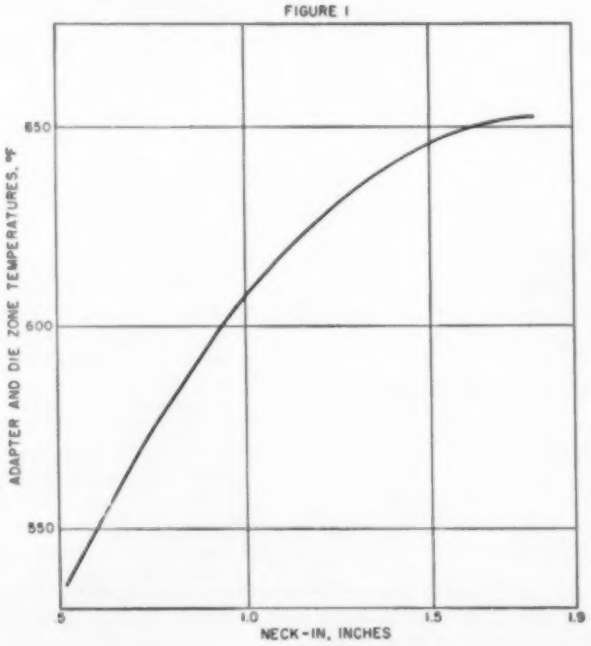
Because of the interest in minimizing neck-in and beading, the Technical Service Laboratory of U.S.I. has carried out research on this condition. The work has established that neck-in is dependent on both machine conditions and basic resin properties. It has also established a number of steps which can be taken to reduce neck-in.

Machine Conditions Which Reduce Neck-In

Neck-in is mainly a function of three machine variables—draw-down distance between die lips and chill roll, die setting and die zone temperature.

In flat-film casting, neck-in decreases rapidly as draw-down distance decreases—roughly ¼ in. per inch of draw-down distance.

FIGURE 1



Neck-in decreases as the die setting decreases. In one instance, U.S.I. engineers found that average neck-in decreased by 0.4 in. as the die setting was decreased from 20 to 10 mil, all other conditions remaining equal.

Neck-in also decreases when adapter and die zone temperatures are kept low compared with barrel zone temperatures. Figure 1 illustrates this effect. In this test the average barrel zone temperature was kept constant at 607°F. When adapter melt temperature was lowered from 607° to 550°F, neck-in on each side decreased roughly from 1.0 to 0.6 in.

Resin Conditions Which Reduce Neck-In

U.S.I. engineers have found that neck-in increases with density and the logarithm of the melt index. As melt index increases, average molecular weight decreases. The resin becomes less viscous and has a greater tendency to neck-in at the sides during draw-down. For this reason, temperatures at both ends of the die are often kept lower than at its center.

Minimizing Neck-In Is Often Difficult

Machine conditions and resin properties which reduce neck-in cannot always be utilized fully because they may affect other essential properties or economy adversely. A few examples follow:

- While comparatively *low* adapter and die temperatures have a reducing influence on neck-in, good adhesion to the substrate depends primarily on *high* stock temperatures.

- And while neck-in can be considerably reduced by using a polyethylene of *lower* density, *higher* density improves moisture resistance, impermeability to oxygen, chemical resistance, stiffness, strength and other properties which may be essential.

- A combination of low density and low melt index will result in minimum neck-in, but unfortunately there is an optimum combination below which voids in the hot web will occur at high operating speeds.

It is obvious that neck-in is not an easy problem to solve, and must be dealt with on a compromise basis. U.S.I. Technical Service engineers are available at all times to work with extruders toward minimizing this troublesome condition.

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U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

Packaging Notes

New Shock-proof Package has been developed for dropping medical supplies by air without the use of parachutes. The package features a flexible tube of polyethylene twist-suspended inside a fiber case by means of rings attached to the case. In addition to drop tests, the package has been subjected to water-spray and other tests.

Although developed primarily as a drop case for military and disaster use, the package has attracted the attention of electronic tube manufacturers and instrument makers as a replacement for the more costly and less safe packaging now in use.

Polyethylene and Steel Returnable Container for the shipment of corrosive chemicals is now being marketed. The container features a polyethylene inner container with a steel drum outer jacket. Compared with conventional glass carboys, the new container is claimed to have a lower package cost, lower tare weight, and less cubage . . . with consequent savings in freight and handling costs. Container is being made in two sizes: standard weight 14 gallon with 5¾ pound inner container, and the heavy-duty 13 gallon with 8¾ pound inner container.

Polyethylene Zippers are being used on filter cloth bags. The zippers are jam-proof and corrosion-resistant. The poly zipper strip is sewn to the cloth with a special stitch that prevents leaking. Zippers ride in smooth grooves with no teeth to snag or collect dirt. Closure is said to withstand 80-pound pull.

Self-venting Poly Closures for Drums eliminate the need for separate vents on containers used to ship liquids. The venting feature is an improvement on the retractable polyethylene spout familiar to users of liquid chemicals in metal drums.

The improved spout prevents liquid surge or "glug" in pouring. It is claimed that there is no waste or spillage, since the closure will vent in any pouring position. The polyethylene cap for the new spout also features a small bail to facilitate pulling the spout up into pouring position.

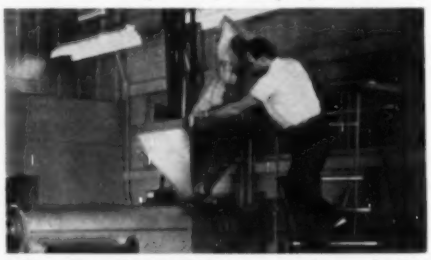
Self-venting flexible spout pours easily from any position. Picture shows spout being raised into pouring position via new bail on reseal cap.

New Petrothene® Shut-down Resin Solves Problem of Post-startup Rejects

Eliminates High Temperature Degradation of Resin Left in Machine

A special shut-down resin is being made available as a service to customers by U.S.I. Intended for use immediately before shut-down, this material is designed to prevent the high temperature degradation that is usually encountered in polyethylene processing equipment during normal shut-down and start-up procedures.

When a machine operating on conventional resin shuts down, the product immediately after start-up is usually unsatisfactory. Gels, fisheyes, discolored particles, and other evidences of resin deterioration show up, not only in the initial production, but sometimes for hours afterward. The reason: Resin in some parts of the machine is held too long at too high a temperature. Thermal degradation results.



Adding Petrothene 205-1 to purge the production resin from the machine just prior to shut-down eliminates usual waste at start-up.

U.S.I.'s answer to the problem is PETROTHENE 205-1, a specially prepared resin that will withstand prolonged exposure to high temperature. When this material is in the machine during normal cooling and heating periods before and after shut-down, minimum thermal degradation takes place.

The technique for using the resin is simple. A few minutes before shut-down the special resin is fed to the machine. When the normal resin has been purged, the machine can be shut down. There is little or no waste and no after effect in the machine when the new resin is used.

PETROTHENE 205-1 is supplied in pellet form, packed in 50-lb. bags. Full details about this special shut-down resin may be obtained by contacting your nearest U.S.I. office.

New Resin for Poly Pipe Wins NSF Approval Seal

A new U.S.I. polyethylene resin — "Petrothene" 102-216 — has been given the National Sanitation Foundation Seal of Approval for use in potable water supply pipe. Pipe made with the new resin has given outstanding results in tests conducted at U.S.I.'s Research and Development Laboratory. Minimum quick burst pressure was 15 to 20% above the minimum required under the Department of Commerce specification CS197-57. No failures were encountered in the slow burst test or in 96 hours of stress crack testing. Information on this resin and other NSF-approved PETROTHENE resins may be obtained from your nearest U.S.I. office.

Visit U.S.I. in Booth 501, Nat'l Plastics Exposition

Quality control as a joint responsibility of the resin supplier and his customer is the theme of U.S.I.'s exhibit this year. "Live" tests on resins, laminates, molded and extruded items are highlighted. A special feature is an information booth manned by U.S.I. technical service men to answer questions on polyethylene production and application problems. Be sure to visit U.S.I. in Booth 501!

Polyethylene plus Glass Fiber Yields New Basic Film Material

Polyethylene is now being reinforced with glass fiber to produce a new film that combines the advantages of both these materials. The film, reinforced with non-woven glass fabric, is at present being made in a range of gauges and in clear and black.

Glass fiber reinforcement gives dimensional stability to the film, so that it does not stretch or billow. It also increases the film's break, burst, and tear strengths, which gives the film longer life in rugged applications and makes possible the use of thinner films. Four-mil reinforced film is said to more than do the job of 6-mil unreinforced film.

Other advantages cited include easier repair because any tears or rips are localized, easier heat sealing because films are thinner, higher grommet strength, and low cost.

DO YOU HAVE a new polyethylene packaging development you'd like the industry to know about? Make it routine to send your information on new developments to U.S.I. POLYETHYLENE NEWS.

Address the Editor,
U.S.I. POLYETHYLENE NEWS, U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., 99 Park Avenue, New York 16, N. Y.

Bowling Equipment Manufacturer Switches To Molds Made With

POLYTOOL Epoxy Tooling Compounds

The molds used to form the "Fairlane" bowling alley equipment produced by the M. Blatt Co., Trenton, N. J., formerly chipped and cracked when molded parts were removed. They needed replacement after a single year's service. Now, the same molds are being constructed with RCI POLYTOOL epoxy tooling compounds.

"After six months of heavy usage," says Mr. Louis Tavani, shop foreman, "our first epoxy mold is free of any chipping or cracking. We now expect molds made with the RCI epoxy compound to last at least 5 years!"

These RCI epoxy materials promise any company greater mold durability, which means big savings on production costs. Greater dimensional stability and resistance to shrinkage are other important features you'll find in RCI POLYTOOL epoxy compounds.

The actual finished products derived from these Blatt Company molds (such as the bench shown above) are constructed of RCI POLYLITE polyester resin reinforced with glass cloth. The coloring comes from an RCI gel coat that is applied to the mold first.

The M. Blatt Co. constructed their first epoxy mold with the help of a Reichhold technical representative skilled in the use and performance of POLYTOOL compounds.

Why not write RCI for full details on the profit-potential of POLYTOOL epoxy tooling compounds and POLYLITE polyester resins in *your* application?

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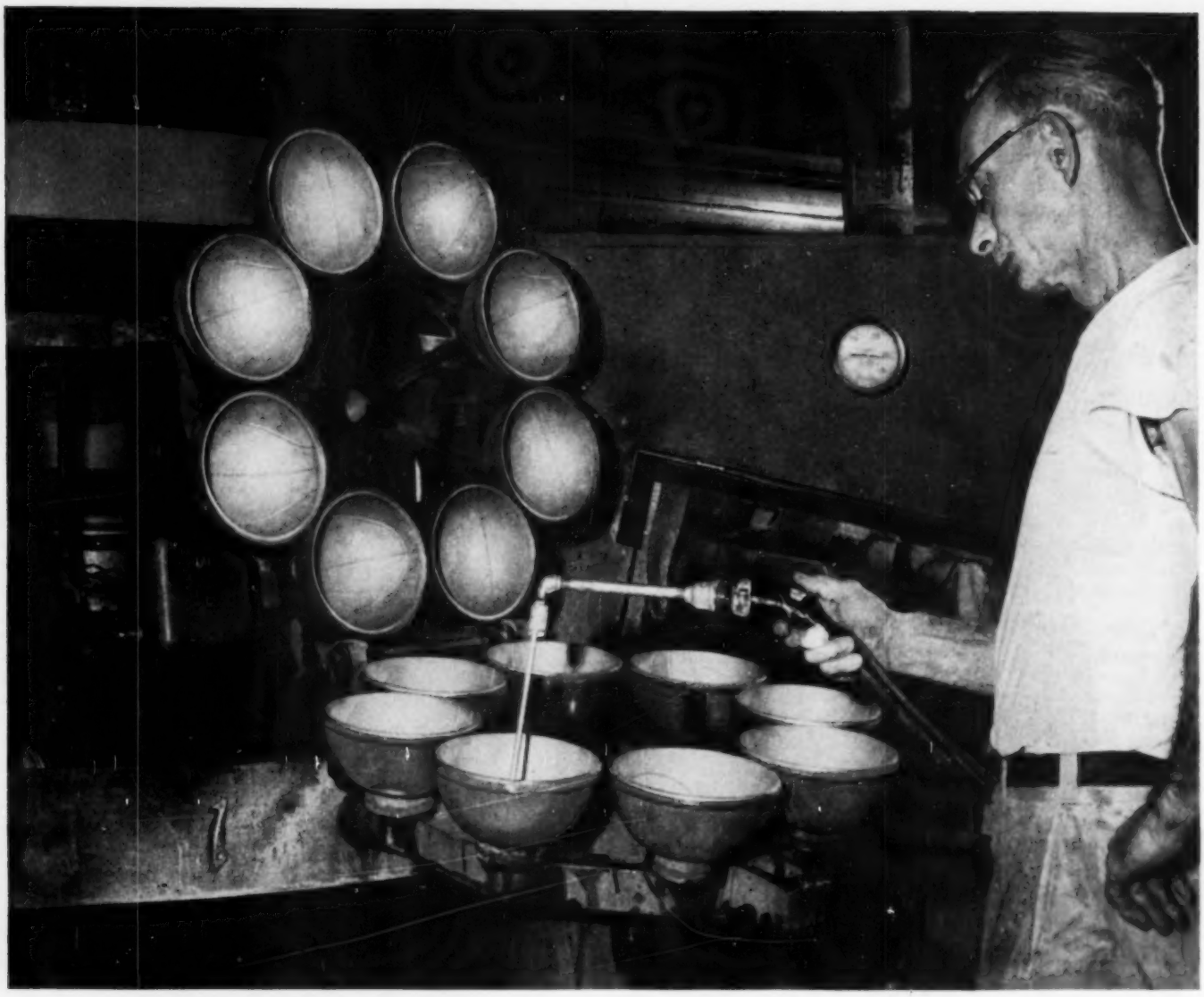

Photo courtesy National Latex Products Company, Ashland, Ohio.

For trouble-free slush molding of vinyl plastisols... Monoplex S-73

MONOPLEX S-73 ester plasticizer provides the formulator of vinyl slush molding compounds with the basic properties he needs for trouble-free production—low viscosity for ease and uniformity of molding . . . low volatility to resist the heat of high-speed molding . . . stability against increases in viscosity. In addition, this monomeric ester imparts the qualities of low temperature flexibility and resistance to heat and light degradation that mean products with a long, satisfactory service life.

If you are making dolls, toys, balls—or any products where these qualities are important—you'll want complete information on the MONOPLEX monomeric plasticizers and the PARAPLEX family as well.

Whether you need plasticizers with outstanding resistance to migration or resistance to extraction by soaps, detergents and hydrocarbons, there is a MONOPLEX or PARAPLEX grade to answer your need effectively and economically.

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MONOPLEX S-73

PLASTICS TECHNOLOGY

NOVEMBER, 1958

EDITORIAL: Hail to the "Hula Hoop!"

In view of the continuing popularity of the "Hula Hoop" and the other names given to the plastic hoops, we feel it only proper to express editorial appreciation, on behalf of the entire plastics industry, for what the hoops have meant to the plastics industry.

•

At first, the hoop appeared to have all the earmarks of a fad or craze that would soon die out. But that did not take place. With the coming of Fall and Winter weather in many parts of the country, the only effect of the change in seasons has been to move the hoop rolling indoors. Children in all parts of the country are still avidly rolling their hoops, and plastic hoop production is still very much in evidence. The question now is will the hoop go the way of all long-term fads or will it become a permanent part of our toys and games assortment?

This is all very nice for the user, but what has it meant to the plastics industry? As my daughter asked, "You mean that the hoops weren't designed only to please us kids?" The reply given her was only a juvenile version of the answer, but the true answer is given in the following:

•

Almost every plastics extrusion machine in this country has put in part, if not all, of its productive work record on the extrusion of hoop tubing. Some 15,000,000 pounds of plastic material has gone into hoop production and the end is not yet in sight.

In addition to this "shot in the arm" for the extrusion field, an even more important result has been the depletion of excess stocks of extrusion materials by the suppliers, and scrap by the extrusion firms.

Since the engineering requirements for the hoops (i.e., resistance to cold flow or deformation, and lack of unpleasant odor) are low, the hoops have enabled the plastics industry to dispose of all under-grade material — this is an important effect, since start-up of any new resin plant produces quite a lot of low-grade material while the bugs are being ironed out of the new production processes. And we all know that many new resin plants have gone on-stream this year.

The low service requirements for the hoops permit mixing the resin in 50:50 proportions of off-grade and on-grade material, and still come up with a satisfactory hoop. Low as the requirements are, a satisfactory plastic hoop would still fall under our editorial definition of an engineering product as being one that "meets the service requirements of the application, be it either industrial or consumer in type."

Finally, the hoop has given all extruders, whether or not they had any previous experience with extrusion of the high-density (linear) polyethylene, an education into the techniques for producing suitable extrusions from that relatively-new material. While vinyls, acetates, and others have been used for hoops, the high-density polyethylene is the most popular and the best for the purpose.

We can all pay tribute to the "Hula Hoop!"

Arthur M. Merrill

Editor

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Modern research methods continue to develop . . .

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Since our entry into the Ultramarine Blue field forty-seven years ago, our goal has been to provide our customers with unexcelled Blues of superior quality. In keeping with this policy, we announce the addition of a new series of Ultramarine Blue standards.

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For compounders with imagination . . .

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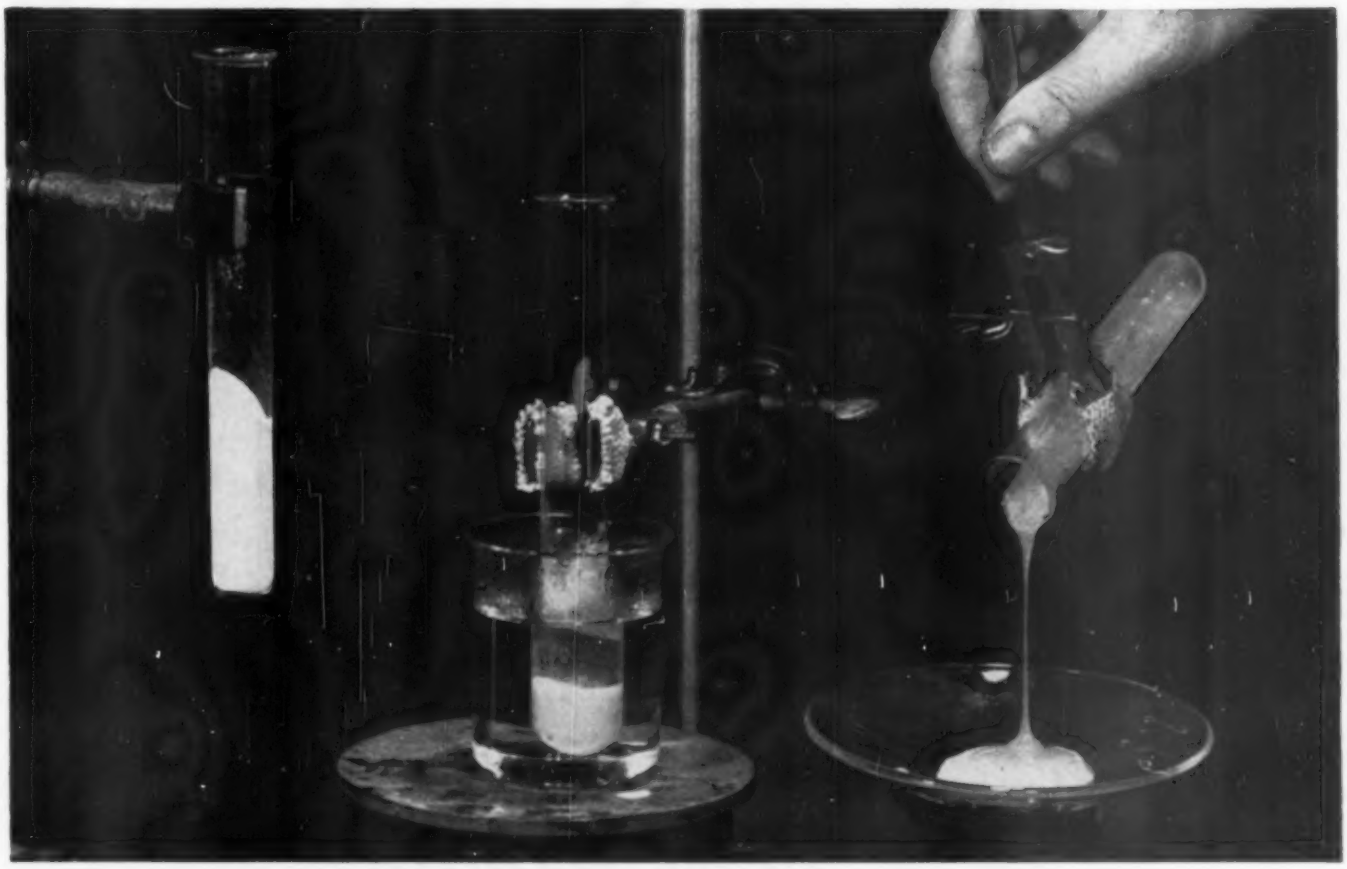

Unique physical advantage:

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Monsanto solid plasticizers can do so many jobs so well for you—can be one of your most valuable compounding aids. In compatible systems, Monsanto solid plasticizers can impart many of the product benefits you want: sharp melting point, easier processing or melt viscosity, heat sealability, low volatility and migration, higher tensile and tear strength, excellent adhesion, lower cost.

At common processing temperatures, they melt and function as solvent-plasticizers . . . make possible higher solids content in adhesives, lacquers, paper and textile coatings—improve flow, leveling, "hot-tackiness" and nonblocking characteristics—aid in wetting fillers, speed fusion of resin binders, boost adhesion of film formers—give easier calendering, extrusion, molding, laminating and postforming properties to rigid products.

Applications? Here are a few which benefit from Monsanto solid plasticizers: heat-sealing coatings; rigid vinyl extrusions, moldings and foams; "break-away" stunt glass; phenolic brake band linings, surface coatings and composition wallboard; melamine coating and laminating resins; urea molding compounds; fire-resistant cellulose acetate sheets; crystallizing lacquers and other specialty coatings; polyamide, vinyl and other hot melts; delayed-tack adhesives, bookbinding adhesives and others.

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Triphenyl Phosphate	49° C.	Santowax R	60-145° C.
Dicyclohexyl Phthalate	64° C.	Aroclor 5460	100-105° C.
Santolite MHP	65° C.	Aroclor 1268	135-160° C.
Diphenyl Phthalate	69° C.	Montar 9	130-160° C.
Santicizer 1-H	87° C.	Montar 4	140-200° C.
Santicizer 9	105° C.	Montar 5	180-250° C.

Chances are, one of Monsanto's solid plasticizers is compatible with the resins you are using—can materially improve your processing or product properties *now*. Write today for more information in the *new brochure*, "How you can benefit from Monsanto solid plasticizers."

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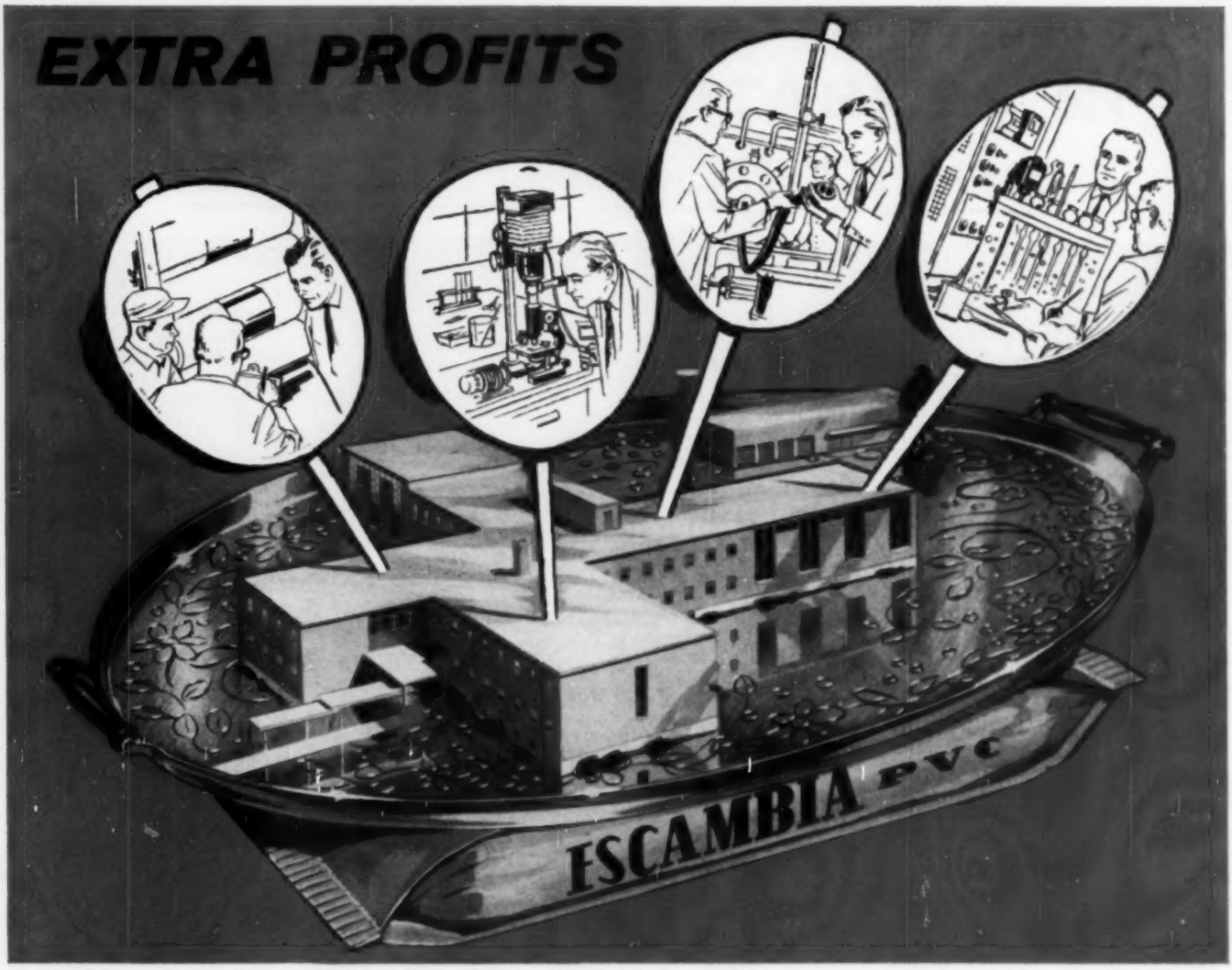

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NEWS in BRIEF

Vinyl emulsion-penetrating primers are showing increased consumer demand because of growing popularity of vinyl exterior paints. The repaint market comprises 68% of the residential structures field. Using these primers, brushes and other painting equipment are cleaned with water only.

Custom molders of plastics no longer are the "shock troops" of the industry because of their inability to meet competition and provide low piece-part prices, according to N. W. Oberle, sales mgr. for Baker Brothers' press division (see Guest Editorial, page 1013). Modernization of out-moded presses by more use of automatic molding presses is needed to take full advantage of the new plastic materials and methods available.

Company expansions in plastics were very much in the news this month. A new lab and office building is being built by Air Reduction Chemical at Piscataway Township, N. J., together with an extensive pilot-plant facility. The firm is also erecting a polyvinyl alcohol plant at Calvert City, Ky., that is planned to produce 20-million pounds annually. Escambia Chemical opened its new research lab in Wilton, Conn. G-E announced the completion and start-up of a semi-works plant for its Lexan polycarbonate resin in Pittsfield, Mass. B. F. Goodrich opened its new $3-billion Carbopol plant at Calvert City, Ky. A phthalic anhydride plant is scheduled by Reichhold Chemicals for erection in Elizabeth, N. J. The company also plans to build a new resins plant near Houston, Tex., for its line of alkyds, polyesters and emulsions.

Business developments in the plastics industry over the past month were many in number. Atlantic Chemical purchased controlling interest in Macromol Corp., basic producer of macro-molecular chemicals and polystyrene resins under the Klein process, and also constructor of polystyrene-producing units both here and abroad. Fiber Industries, Inc., is the new name replacing Lindum Fibers Corp., of the joint Celanese-I.C.I. venture. The new company plans to build a plant near Shelby, N. C. The plastics division of Ciba Co. merged with its manufacturing affiliate, Ciba Products Corp., which will be the headquarters for all Ciba management, sales, and technical service for Araldite epoxy resins, and will operate from Kimberton, Pa. until new research and production facilities are completed in Toms River, N. J., and new administration and sales offices are transferred to new quarters in Fair Lawn, N. J. Du Pont plans to enter the polyethylene film field, using a new lab and pilot plant to be built adjacent to the firm's Orange, Tex., plant. The Farrel-Birmingham company has purchased the West Coast extruder manufacturer, Electrophysical Engineering Co., Orange, Calif. G-W Plastic Engineers, Inc., a precision molder, is offering an injection mold design service.

New materials of special interest (see pages 1044-5): two high impact PVC resins; all-purpose polyester resin pre-impregnated glass fabric; red-shade phthalocyanine pigment for polystyrene; solvent-base detergent and cleaner for uncured resins; low-cost wood flour filler; splicing adhesive for foams; and epoxy resins and intermediates.

New Equipment to be noted (see pages 1048-50): rotating pipe unions having ceramic-coated seats; electric motor speed controls having other plastic shapes; heavy-duty granulator for tough-grinding plastics; plastic bubble-packaging machine; oil cooler for injection machines; portable foam compression tester; high-speed plastics welder; and infra-red heating units for single or panel use.

Plastics Applications worthy of attention (see pages 1052-4): metalized Mylar tapes; Kel-F tubing for pharmaceuticals; molded nylon roller skates; extruded PVC jacketing for cables; triacetate base material for photo film; glass-polyester sleeper cabs for trucks; epoxy grouts for ceramic tiles; boats of expanded polystyrene; Teflon-insulated sockets for transistors; cleaner for plastics and glasses; and snap-in nylon terminal bushings.

HERE ARE FACTS ON HOW WITH TODAY'S

TYPICAL PROPERTIES
High-Density Polyethylene

Melt Index, dgm/min	0.3–8.5*
Secant Modulus, at 1% elongation, psi	90,000–150,000*
Yield Strength, psi	3,100
Tensile Strength, psi	3,300
Tensile Impact, ft. lbs/in³	70
Elongation, per cent	50
Hardness, Durometer "D"	56
Dielectric Constant, 50MC	2.34
Dissipation Factor, 50MC	0.0002
Melting Temperature Range, deg. C	120–130

**Depending on specific product*

Q. Is high-density just "another" polyethylene?

A. With a density range from .942 to .965, BAKELITE Brand high-density polyethylenes are, in many respects, completely new materials. They offer improved rigidity and excellent dimensional stability at both high and low temperatures. Resistance to chemicals is greater and vapor and liquid permeability is reduced.

Q. Is it possible to obtain all densities from one polyethylene supplier?

A. Yes, with the addition of these high-density materials, the BAKELITE Brand polyethylene line now includes densities from .915 to .965.

Q. Can existing molding equipment be used?

A. Because BAKELITE high-density resins permit faster molding cycles, some modifications in runner, sprue and gating design may be required. Good principles of mold design should be followed. All other techniques need little or no change.

KNOW-?

YOU CAN SAVE

NEW BAKELITE BRAND High-Density Polyethylene

Q. What are the advantages of BAKELITE Brand high-density polyethylene for injection molding?

A. BAKELITE Brand high-density polyethylene compounds permit thinner sections without loss of rigidity or load-bearing characteristics and offer easier flow with higher melt index for multiple-cavity molding.

Q. What are the advantages for blow molding?

A. BAKELITE Brand DMDA-4901 is capable of withstanding sterilization temperatures of 250°F. at 15 psi. steam pressure. It provides stiffness 4 to 5 times that of low-density resins, reduced permeability, excellent printability.

Q. Can Bakelite Company provide a compound for specific needs?

A. There are presently nine BAKELITE Brand high-density polyethylene compounds incorporating properties that meet the over-all requirements of customers for molding, extrusion coating, film extrusion, monofilaments, contour extrusion and sheet extrusion for vacuum forming.

Q. What factors assure uniformity?

A. In new Bakelite Company plants for production of high-density polyethylenes, processes are fully automated for quality control. Newly developed blending equipment produces blends with batch-to-batch uniformity in box-car quantities. Over all, there is the 40-year experience of Bakelite Company in producing quality plastics.

Q. Is additional technical data available?

A. Yes, in technical bulletins obtainable on request to your Bakelite Company Technical Representative, or by writing Dept. KG 33G.

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Materials and processes, properties, handling methods—the whole range of information needed to make effective industrial use of epoxy resins is covered concisely and soundly in this book. Applications in industrial castings, surface coatings, high-strength adhesives, durable laminates, solders, lightweight foams, and potting compounds are covered, against a background of the chemistry and technology of the basic resins and their reactions in curing. Also including many data in tabular and graphical form, the book will enable you to begin with a particular application, of specific performance requirements, and to formulate a compound that will very closely approach your needs.

Just Published

EPOXY RESINS

Their Applications and Technology

By HENRY LEE and KRIS NEVILLE

The Epoxylite Corporation

305 pages, 176 illustrations, 87 tables, $8.00

THIS book provides a comprehensive guide to the new field of epoxy resins, covering the chemistry of their preparation and their applications in industry.

The available data on the resins are brought together, and information given on their synthesis and curing mechanisms, curing agents, and the various materials used as fillers and modifiers, with emphasis on the engineering versatility, range, and potentialities of the epoxies.

In specific terms, the book discusses the industrial applications for the resin systems in a variety of cases where superior product performance may be obtained by their use.

Application techniques are discussed, handling characteristics are considered in detail, and the methods for characterizing both cured and uncured resins are presented. On the basis of the extensive tabular and graphic data included, practical formulations are developed for a number of industrially valuable compounds.

In all, here is information of the most practical sort for you, not only prepared by specialists in the field, but also reviewed, and with contributions included, by 20 other specialists in firms intimately concerned with epoxy resins.

Technical facts and working data in these 12 chapters

1. Epoxy Resins—Their Synthesis and Characterization
2. Curing of Epoxy Resins
3. Primary Aliphatic Amines and Their Adducts as Curing Agents
4. Amines (Continued), Amides, and Latent Curing Agents
5. Organic Acids and Acid Anhydrides as Curing Agents
6. Diluents, Fillers, and Resinous Modifiers
7. Plasticizers and Flexibilizers
8. Casting, Potting, Encapsulation, Sealing, and Lightweight Foams
9. Adhesives
10. Laminates
11. Coatings
12. Handling Methods and Safety Precautions

Crammed with practical information on such topics as:

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- —synthesis of mixed resins
- —commercial epoxy resins
- —resin characteristics
- —curing by crosslinking agents
- —effect of chlorine content
- —calculation of amount of curing agent to use
- —degree of cure
- —characterization of the cured resin
- —cyclic aliphatic amines
- —latent catalysis
- —quantities of diluents used
- —incorporation of fillers into resin
- —monofunctional flexibilizers
- —casting of large or complex shapes
- —selective improvement of adhesive characteristics
- —heat-curing adhesive formulations
- —theory of glass-fiber laminates
- —type of glass or cloth and its surface treatment
- —properties of the cured laminate
- —non-ester containing solution coatings
- —heat-convertible curing agents
- —use of epoxy resins in production
- —optimum batch size
- —use of application equipment
- —elimination of adverse physiological reactions

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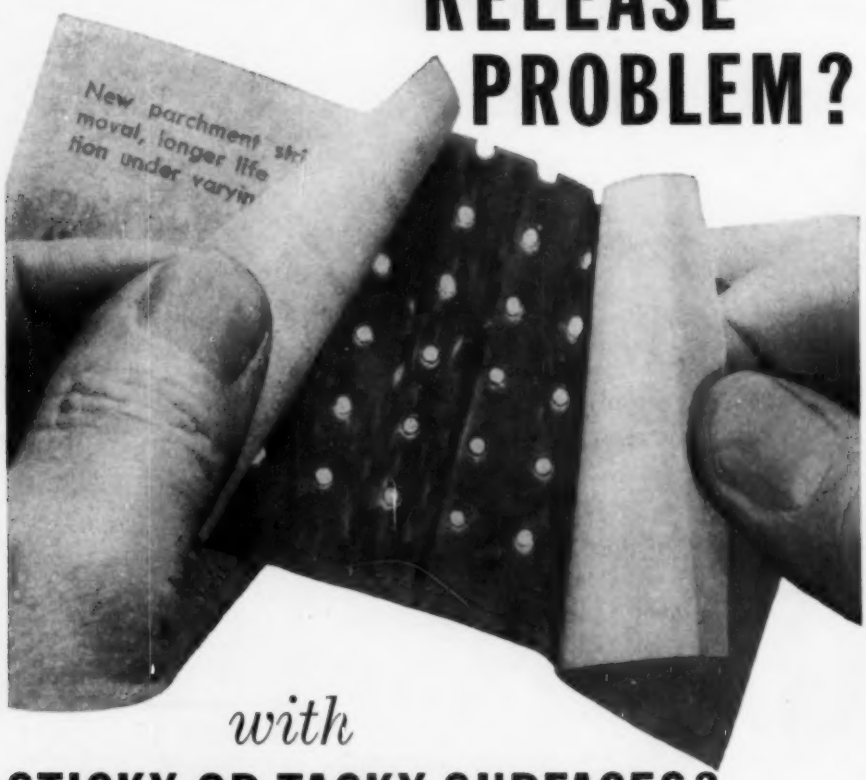

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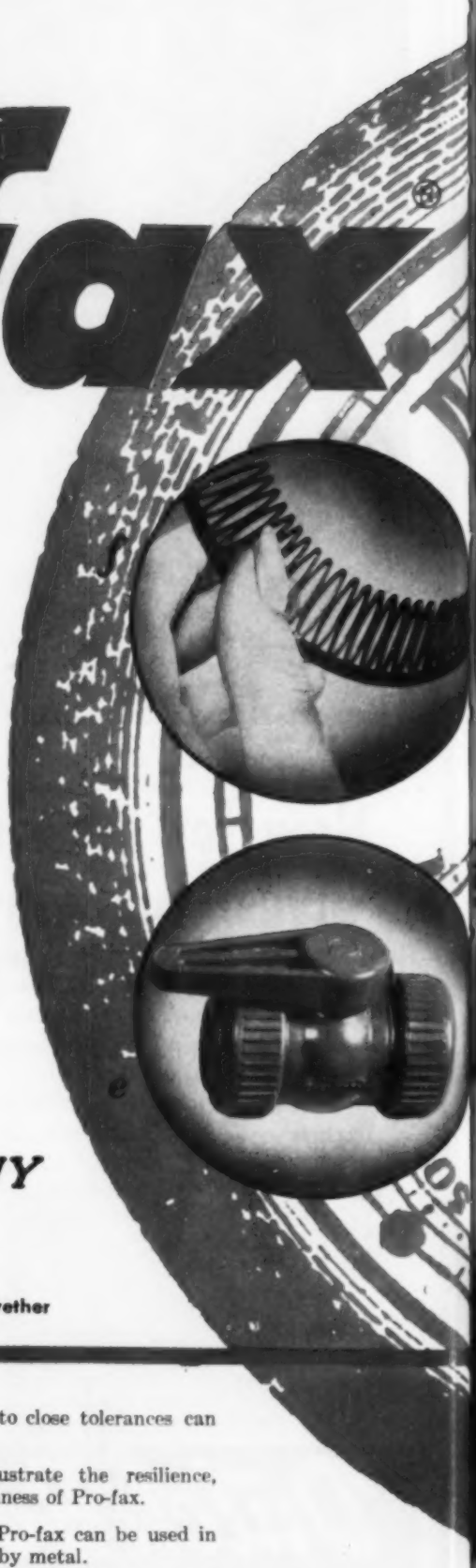

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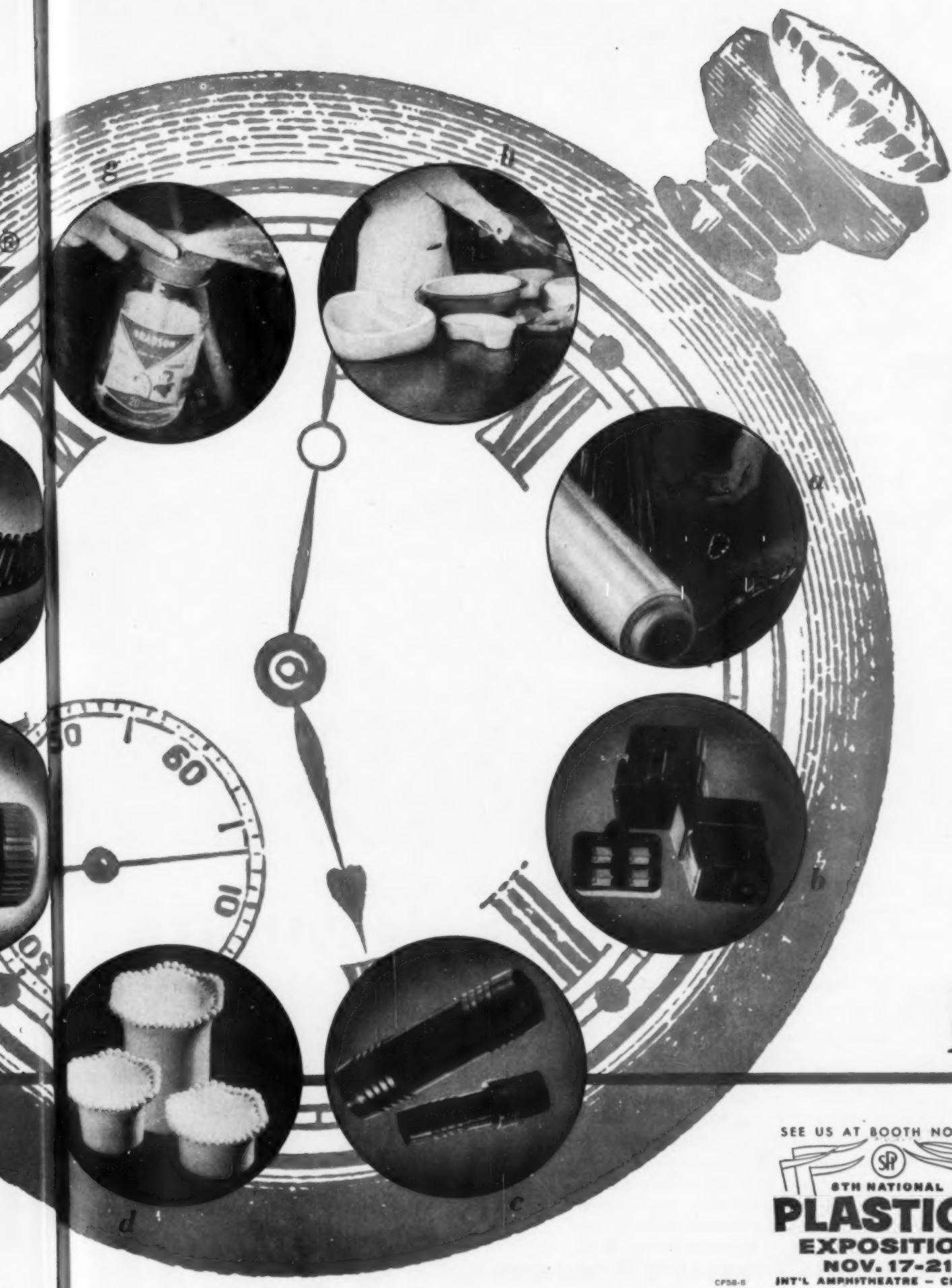

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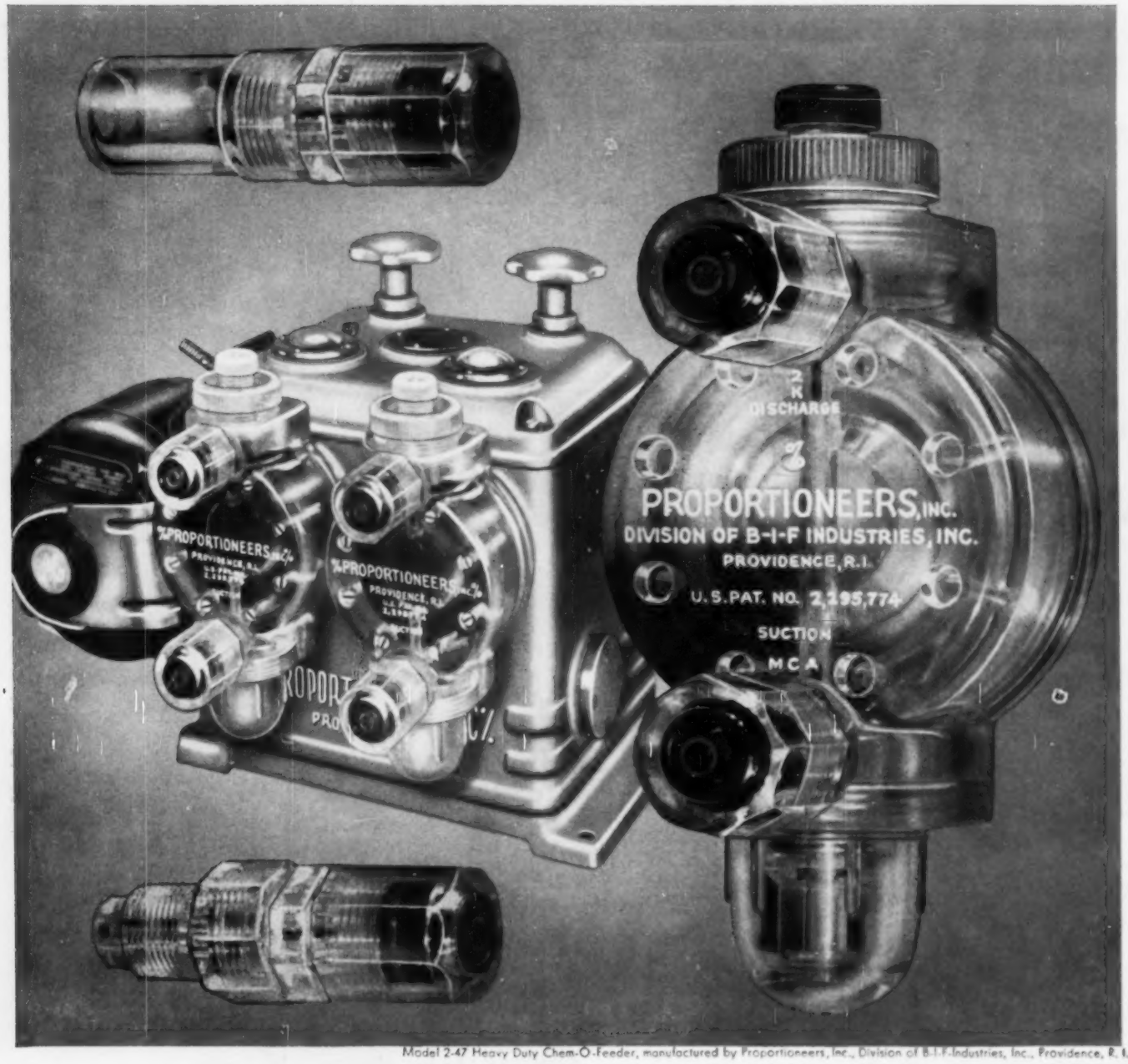

Model 2-47 Heavy Duty Chem-O-Feeder, manufactured by Proportioneers, Inc., Division of B.I.F-Industries, Inc., Providence, R. I.

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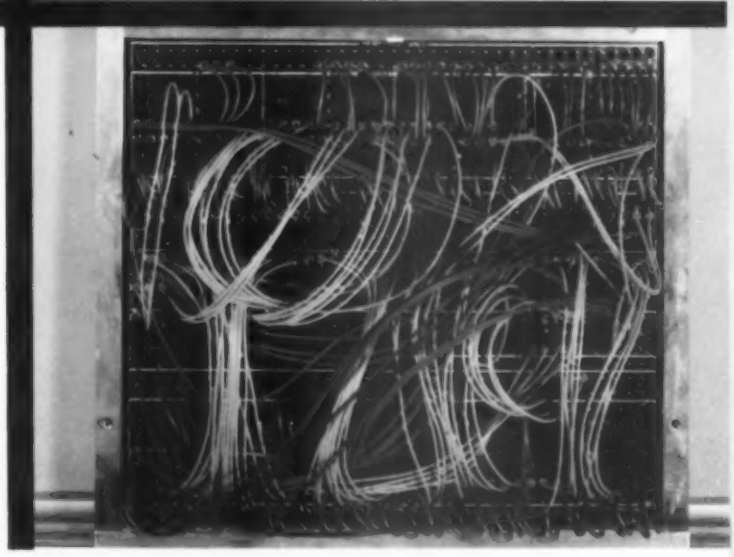

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PVC-450	1.35	Dry blend extrusions. Calendered film and sheeting. Rigid applications. Wire insulation.	Rapid plasticizer absorption. Clarity and freedom from gel particles. U.L. Approved.
PVC-40	1.10	Calendering and molding. Semi-rigid sheeting.	High calender production rate. Good flow, heat stability.
PVC-35	0.85	Base for high gloss injection molding compounds. Processing aid.	Excellent flow. Improves processing without sacrificing heat stability.
PVC-30	0.63	Processing aid in molding and calendering.	Reduces temperature requirements and shortens production cycles.
PVC-25	1.10	Designed for unplasticized applications. Injection molded items or calendered rigid film and sheet.	Good flow and superior heat stability. Can be handled in standard equipment.
PVC-60	1.63	Supported and unsupported calendered film and sheeting. Extrusion.	High monomeric and polymeric plasticizer absorption. Cold dry blends.
CR-80 (Copolymer)	0.60	Records and rigid film.	High flow, low volatiles.
FCR (Copolymer)	0.63	Flooring.	Easy processing and high bulk density.
PVC-70 (Paste resin)	2.00	Plastisols and organosols.	Good clarity, viscosity, heat stability and shelf life.

Resin	Specific Viscosity	Applications
PVC-50	1.55	Calendered film, sheeting. General extrusions. Wire insulation (U.L. Approved).
PVC-45	1.35	Calendered film, sheeting, coated fabrics. Extrusion profiles, tubing, molding compounds.
PVC-FG (Resins)	0.63-1.35	Flooring.

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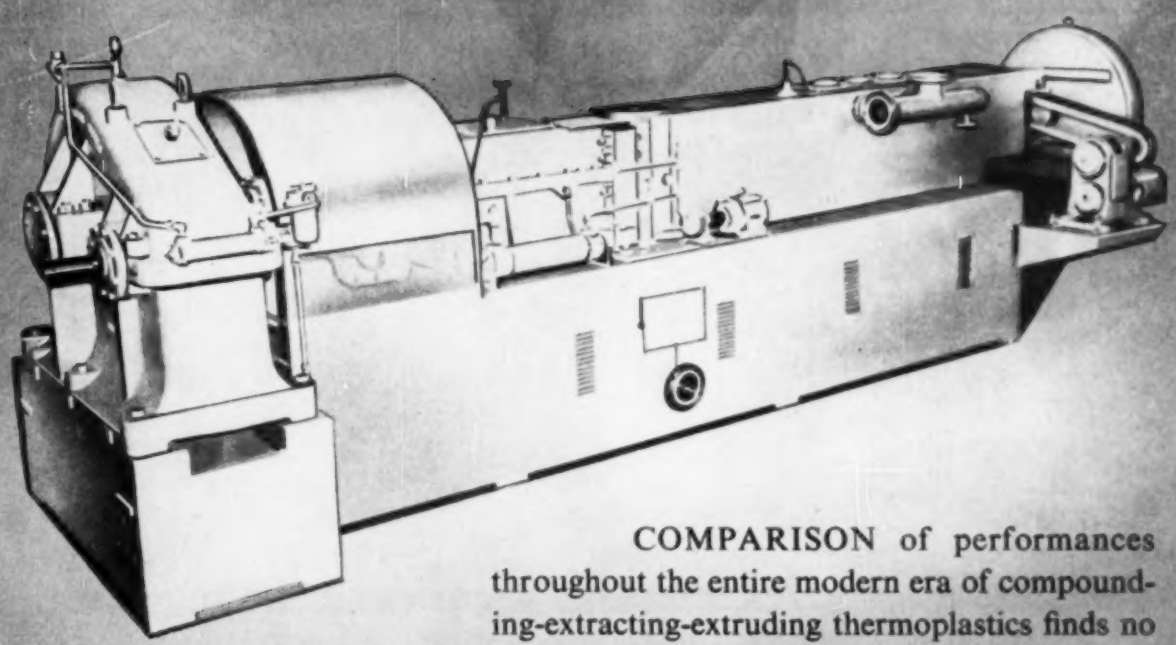

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Correcting Warpage in Reinforced-Plastic Products

Warpage can be corrected by easily-accomplished design changes in the molds, rather than by use of shrink rules.

THOMAS HARRIS, *Vice-Pres.*
Structural Fibers, Inc.
Chardon, Ohio

THIS paper covers some measures that have been taken to correct warpage in finished reinforced-plastics products by allowing for shrinkage in the mold design. Practically every manufacturer of reinforced plastics has been plagued by parts that, when taken from the mold, warp out of shape. The extent of warpage varies with the many different combinations of surfacing mats and percentages of filler, type of resin, and many other variables too numerous to mention. It would seem that there is no hard and fast way to cure this problem, such as the various shrink rules used by the pattern-maker for aluminum and other metals. However, a good start can be made by checking various parts of a similar design that already

Thomas Harris was born in Scotland in 1909. After graduating from high school, he attended night school. In industry, he has been an experimental mechanic, tool and die maker, machine shop foreman, and a project engineer on major electrical appliances. He has spent 11 years in the reinforced plastics field as a project engineer, and also served Case Institute of Technology as a consultant on reinforced plastics. He is a member of SPI. Mr. and Mrs. Harris have four children, and make their home in Gates Mills, Ohio.

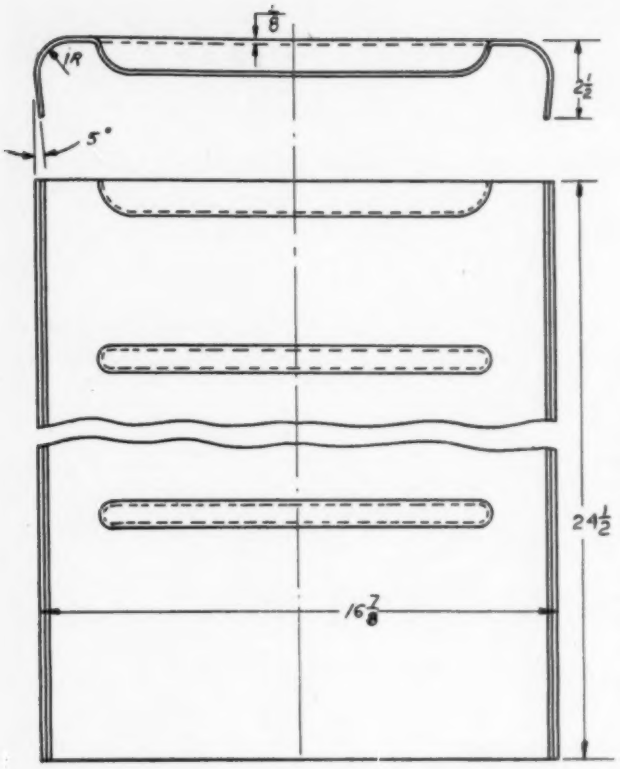

Fig. 1. Molding for welding cabinet back, showing no correction for warpage.

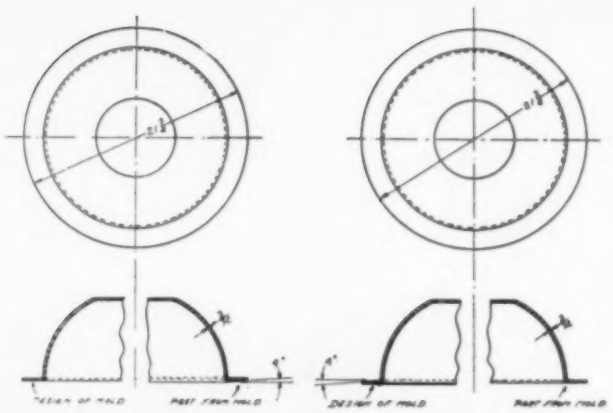

Fig. 2. Flanged domes with (left) no allowance for warpage, and (right) with design showing allowance for warpage.

have been molded without any corrective measures taken in molding. We were fortunate in having parts of this nature available.

Welding Cabinet Panel

Figure 1 represents a black panel for a welding cabinet, and there were four pieces in the cabinet assembly. The back and front panels were similar in that they were flanged, while the two side panels were straight with an off-set to compensate for the flanged parts. These four parts, when assembled together with

(*Continued on page 1033*)

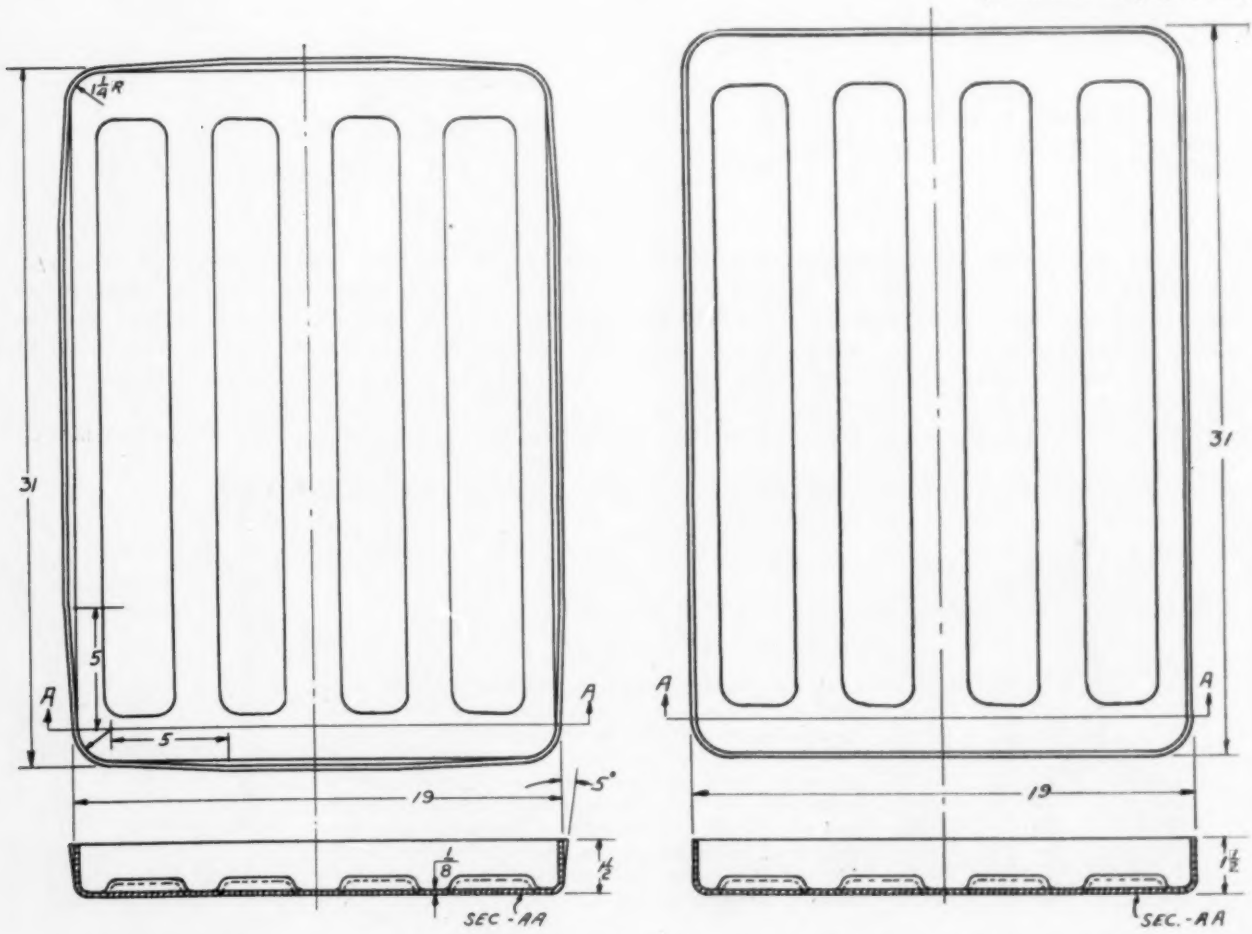

Fig. 3. Field chest cover, showing (left) mold corrections for warpage and (right) part from corrected mold.

DON MAY, *Vice-Pres.*
May Mfg. Corp.
Woodside, N. Y.

Ultra-Sonic Cleaning of Plastic Spectacle Frames

How one manufacturer, using ultrasonics,

saves $5,000-10,000 annually in cleaning time, effort, and trouble

ULTRASONICS, known for their ability to clean complicated mechanisms in minutes, also will save much time and money in cleaning relatively simple shapes. The eye-glass frames we make are an excellent case in point.

To insure a lustrous, long-lasting finish, we buff a dense layer of jeweler's rouge-and-wax combination over each frame. Excess buffing compound and soil accumulated during the frame's route during manufacture have to be removed. This is very difficult in the lens grooves of the plastic frames.

Before using ultrasonics, we had two ways of eliminating this unsightly condition, both unsatisfactory. We tried an acid solution which etched away the dirt. However, the acid did not discriminate between buffing compound under the shield and buffing compound on the frame. Most of the carefully built-up polish was removed, therefore, resulting in a product that would not hold its shine for long.

The other method, which we had been using, required the following four steps: (1). The frames were scrubbed with a stiff rotating brush (see Figure 1); (2). After this, three operators, using picks, scraped off the remaining dirt (see Figure 2); (3). Frames then were immersed in a washing machine for 20 minutes; (4). Finally, the frames were hand-dried with a cloth. With this method about 500 frames per day were processed, each requiring two to four minutes.

Frame Manufacture

The two basic materials used in quality eye-glass frames are either acrylic or cellulose nitrate plastic. These are purchased as 20 x 50-inch sheets, varying in thickness from 150-450 mils, with 175 mils as average. Sheets are cut into workable sizes (four by six inches), heated slightly in an oven to make them soft, and then frames and temples are die-cut (see Figure 3). Our inventory is a story in itself; a single style presently in fashion, for example, has 12 colors, 12 types of trim, and 16 sizes!

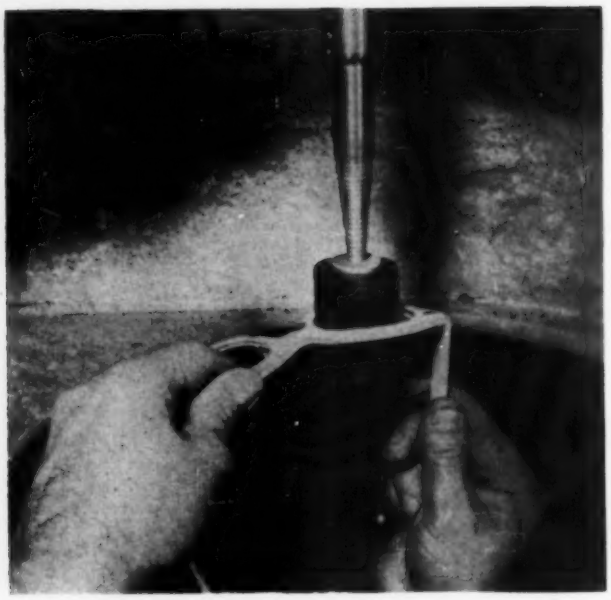

Fig. 1. Former cleaning of frames used stiff, rotating brush.

Fig. 2. Old method for removing traces of jeweler's rouge used hand-picking.

Frames are beveled on the outside, grooved inside, and nose pads are cemented on with acetone (see Figure 4). Next, shields are inserted into frames, hinged temples attached, and the protruding pins in back of the frame are spun (much like riveting) to fasten shield, hinge, temple, and frame together permanently. Temple fronts near the frame are tumbled (see Figure 5), sanded and polished individually to insure proper folding, and a thick layer of jeweler's rouge and wax is buffed onto frames. After this, the frames are cleaned (see Figure 6) ultrasonically and routed to the trim department, which adds any required ornamentation.

Use of Ultrasonics

Now that we have installed a Branson Model AP-50 Sonogen* ultrasonic generator, with a five-gallon capacity Type T-108 tank-transducer combination, we are able to clean approximately 10 times the number of frames processed previously. In addition, one operator can handle an entire day's production. The others since have been shifted to other functions. Time savings directly attributable to ultrasonic cleaning are adding up to some $5-10,000 per year.

Using this equipment, 25 frames are placed into a perforated steel basket, immersed in the ultrasonic bath for two to three minutes, and removed completely clean. Rouge, wax, dust, and other soils are gone, yet the polished surface is undamaged. If any dirt still remains, it is loose, and is swept away by the cold water rinse that follows immediately. Finally, the frames are dried under a stream of warm air.

Heat, conducive to efficient cleaning, is supplied by the energy of the ceramic transducer at the bottom of the tank, so that no immersion heaters are used; any temperature above 120° F. would soften the plastic frames.

Parts in an ultrasonic tank are cleaned by the rapid formation and collapse of thousands of voids throughout the cleaning liquid. This phenomenon, called cavitation, literally explodes dirt off surfaces. Energy for this process is supplied by an ultrasonic generator using a 60-cycle, 115-volt, alternating-current source to produce powerful 38,000-cps. voltage pulses. These pulses are transmitted to a ceramic transducer that converts them to mechanical vibrations of the same frequency. The vibrations agitate the cleaning liquid, causing fast and vigorous removal of oil, dirt, and even insoluble contaminants.

Other Advantages

In addition to saving time and money, ultrasonic cleaning offers a number of other advantages. It takes no more than 10 minutes to train someone to use the equipment, whereas learning to remove excess compound with a pick, without scratching the eye-glass frame (see Figure 2), took weeks of experience. Thus, absences cause no down-time in the cleaning department, since anyone can use the equipment.

Fig. 3. Two frames are die-cut from preheated plastic sheets.

*Registered trade mark, Branson Ultrasonic Corp., Stamford, Conn.

Frames now can be polished all day on Fridays. Before, since the wax-rouge compound hardened over the week-end making it almost impossible to remove, polishing had to stop at noon on Fridays. The Sonogen, however, removes the solidified soilants even more easily than it does the fresh material.

Employee acceptance of ultrasonic equipment was quick and wholehearted. By eliminating the dreary work of picking out minute specks of dirt for eight hours a day, employees were freed for more pleasant duties. Because only the part-time attention of an operator is required to insert and remove frames from the tank, we always have an extra hand when needed.

Another advantage is that cleaning is thorough, without wasting hundreds of gallons of water in complicated circulation systems. Also, no greasy solutions are sent down the drain, inviting expensive plumbing repairs. The faucet at the bottom of the cleaning tank makes it easy to change the cleaning solution twice daily. The solution contains five gallons of water to which 1½ pounds of mild alkaline cleaner and a water softener have been added (the exact amount depends on the quantity, size, etc., of the frames used regularly). After two weeks of constant use, the tank is emptied and the inside scrubbed with steel wool.

Finally, at 38,000 cycles per second, the frequency of ultrasonic oscillations in the equipment that we selected is well above the level of hearing. It does not produce any annoying whistle. The only sound that comes from the tank is a low hum which becomes even lower after parts are immersed.

Other Applications

Our plating department also has found ultrasonics to be excellent for preplate cleaning. Large batches of shields, hinges, jewelry mounts, and the like, all can be thoroughly degreased in a matter of minutes, and a much stronger bond of the gold plating is achieved.

Paint in the grooves of an ornamental frame sometimes must be removed without scratching the plastic underneath. After dipping the frame into the ultrasonic bath for a few minutes, all traces of the paint are gone.

Fig. 4. Nose pads are fused to spectacle frame with acetone.

Fig. 5. Partly-finished frames and temples being removed from tumbler, ready for sanding and polishing.

Fig. 6. Finished frames before (left) and after (right) ultrasonic cleaning, to remove jeweler's rouge and wax.

Another interesting application of ultrasonic cleaning is the "Sunset Glare Guards," a special type of spectacles. Originally used in military psychiatric wards for the alleviation of certain forms of mental illness, these sunglasses have been enjoying a fashion popularity lately. Each plastic lens has 48 pin-holes for "one-way" vision. After rouging and polishing the sieve-like lenses, every pin-hole is clogged with buffing compound. Before the Sonogen was installed, each hole was cleaned individually, a costly, slow, and tedious method. With ultrasonic equipment, however, hundreds of lenses are cleaned in minutes, without handling them manually.

Conclusions

How practical is the installation of ultrasonic cleaning equipment in our plant? We began using ultrasonics in August, 1957. Within four months, the complete apparatus (generator, transducer, tank) had paid for itself in time and money saved, and is helping to make a finer product. We cannot think of a better way to judge the value of new plant equipment. —THE END

Guest Editorial

N. W. OBERLE, *Sales Mgr.*
Plastic Press Division,
Baker Brothers, Inc.
Toledo, Ohio

Modernization

In his August Guest Editorial, "Shock Troops of the Industry," John Bachner, President of Chicago Molded Products, Inc., stated the following concerning custom molders: "We're in danger of forgetting an important essential for any successful business operation—our origin and our aims. Custom molders are the shock troops of the plastics industry. By that, I mean that it has been the custom molder, big or small, who has provided the testing ground for the new and revolutionary materials, been the point of contact between the material suppliers pilot plant, the machinery maker's new press, and the customer's needs."

There is little danger in evidence now—the danger was several years ago. Today, most sizable compression runs have been taken from all custom molders and are firmly established in captive operations. Now, many medium runs are going that way and, obviously, all but the cat-and-dog jobs and the tough insert jobs also will move over to captive operations.

The "are" should be past tense. It generally is agreed that the custom molders were the shock troops at one time. Somewhere along the line, however, they lost their initiative. As the custom molder grew, he could not adjust himself to changing economics as all stable businesses must do. Years ago, presses could be purchased for X dollars. As the years went by, automatic molding machines appeared and sold for XX, and even XXX dollars. Did the custom molders buy them, No; did the captive molder, Yes! At this time, the title "Shock Troops of the Industry" went **and has been** with the captive molder.

You must provide piece-part prices to industry with which it can meet competition. When you cannot, industry investigates producing their own. They did investigate, found that automatic molding machines were well able to produce lower piece-part prices, and went into molding on equipment that was designed and offered **first** to the custom molder. The move obviously was sound, as captive molding has increased ever since and, without a doubt, will continue to grow at an accelerated pace.

To this day, you could list the majority of the large custom molders and not find enough automatic compression molding machines to count on one hand, Baker's or any other's. What happened to those old "Shock Troops?"

The new "Shock Troops" are moving in steadily where the old left off. In addition to purchasing this new automatic equipment, they have gone on to **demand** even bigger and better equipment; 100-ton automatics, 150-ton automatics, and even 450-ton automatics. Automatics, coupled with powder preheaters, in combination with automatic compression-transfer presses, etc. This is progress.

To continue, Mr. Bachner stated, "We think the need for the custom molder in today's market is greater than it has ever been, and that it is up to all custom molders, singly and together, to continue the creative and pioneering activity that has meant so much in the past to the Plastics Industry." We, too, think that there is a definite need for **progressive** custom molders. While it is true that a tremendous quantity of work is gone, and gone forever, there is no use crying over spilt milk. There always is new business available on which to bid. However, you must be in shape to bid on it. New materials are available, new methods are being used, and new automatic molding equipment must be utilized to provide lower piece-part prices.

Mr. Bachner concludes by seeking methods of making the custom molding industry grow. We do have a method. Only through the replacement of old machines by new ones having greater outputs per man-hour can the molding firms work their way out of the cost-price squeeze. Taxes, wages, and materials offer small possibilities of cost savings; the main cost reduction route is in Modernization.

—THE END

P. W. ERICKSON, SR. *Project Engr., (right)*
I. SILVER, *Chief, Non-Metallic Matls. Div., (left)*
and
H. A. PERRY, JR., *Consultant, Non-Metallic Matls.*
U. S. Naval Ordnance Laboratory, (center)
Silver Spring, Md.

NOL Ring Test for Glass Roving–Reinforced Plastic

A new test method is proposed, and flexural, tensile and shear strength data are given for epoxy and polyester rings made with different finishes.

THE use of glass fiber rovings as reinforcements in plastics offers the engineer both a means of controlling the directional strength properties in a laminate, and a degree of strength not possible with woven or mat reinforcements. The rovings, which exhibit great strength in tension or compression, may be laid up such that any desired proportion of the fibers lie in the directions of the principal stresses to be applied to the structure.

The strength properties of a reinforced plastic also are directly related to the over-all glass content. Glass contents up to 75% may be realized in laminates containing glass fabrics, while these drop to 50% for mats with stranded fibers and 35% in a laminate with a jackstraw arrangement of individual fibers. Parallel glass fibers, on the other hand, theoretically can be packed to occupy 91% of the cross-sectional area of the molded part, and glass contents of the order of 85% are obtained readily in certain parallel fiber-reinforced plastics. Cross-plied roving-reinforced plastics may attain 83%, by weight, of glass.

Any large-scale future use of reinforced plastics in weapons structures and other competitive applications is related intimately to the fiber materials cost per unit of the desired property (1)*. Every manufacturing operation, however slight, performed on the fiber adds to the final cost of the product. On a pound basis, costs range from about $3.00 for fine-textured fabric down to $0.34 for certain types of roving. In general, fabrication costs are less with the higher-priced

*Numbers in parentheses refer to bibliography at end of article.

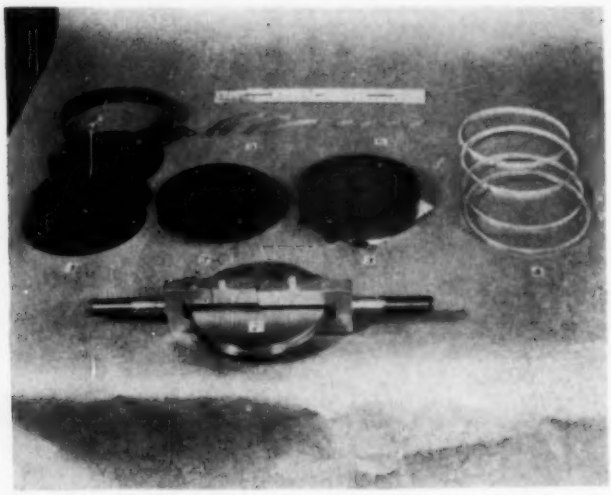

Fig. 1. Tensile test jig, rings, mold and specimens. Legend: 1,2—Split mold components for making ring specimens; 3—Winding component for making rings; 4—Ring specimens; 5—Flexural test specimens; 6—Shear test specimens; and 7—Tensile test jig.

cloth, but there are many structures that may be machine-fabricated from inexpensive roving without excessive labor costs (2).

This Laboratory is interested in the performance of roving reinforced rocket motor tubes and mine cases, and the use of filament-wound ribs, that are reinforcing members in tubular plastic structures reinforced with glass fabrics or rovings. Of general interest to both the Navy and others is the prospect of a low cost filament wound pipe with adequate strength properties for use in corrosive environments. The Defense Department also has supported development work on glass filament-wound spherical pressure vessels for aircraft use. One very successful commercial application of a unidirectional glass reinforcement is the plastic fishing rod which is now almost universally reinforced with glass fiber rovings.

The mechanical properties and environmental resistance of glass fiber roving-reinforced plastics are affected by the following properties of the rovings:

(a). The tensile and compressive strengths of the fibers when embedded in a cured plastic.

(b). The adhesion between the cured plastic and the fibers.

(c). The susceptibility of the fibers to deterioration by water and other adverse environmental factors when embedded in a cured plastic.

(d). The susceptibility of the adhesive bond between the plastic and the glass to deterioration by water and other adverse environmental factors.

The purpose of this report is to describe the development of test methods showing promise for establishing levels of quality with regard to the above factors and for detecting variations from batch to batch of the cured parts.

At the present time, it is not possible for the engineer to utilize fully the design flexibility, strength potential, or the economic advantages of parallel fiber glass reinforcement over those from woven fabric. The main reason for this is the inadequacy of fiber treatments available on roving to promote the necessary adhesion between the resin and the fiber surface. A great deal of work has been done on developing effective chemical finishes for glass fabrics and, as a result, a substantial increase in strength properties in these laminates have been realized (3, 4).

Glass yarns from which textiles are made must be as flexible and abrasion-resistant as possible to withstand the twisting and weaving in the textile operation with minimum fiber damage. To achieve this protection, a sizing is applied to the newly-formed filaments at a point between the bushing and the winder. The only suitable sizings, however, contain starch and lubricants, neither of which are compatible with laminating resins. Laminates made with starch-sized fabric give very unsatisfactory strength properties, especially under wet conditions. As a result, those weaving aids are removed from the fabric by either heat or chemical means.

This is followed by the application of a chemical finish that is compatible with the resin and acts as a coupling agent between the cured resin and the glass. These chemical finishes are by nature both organic and inorganic and lead not only to greatly improved strength properties in laminates, but also enhance the wetting of the fabric by the resin. Improved chemical finishes for fabrics have led to more than a doubling of strength properties in laminates with many resin systems under wet environmental conditions (3, 4).

A second general class of sizes is applied commercially to yarn intended for non-textile use, as in parallel-fiber reinforcements (5, 6). In this case, the bushing treatment is an aqueous formulation consisting of lubricant, film former, and coupling agent. This is poundwise, the cheapest fiber available to the laminator. The effectiveness of the coupling agent, in many cases the same as used in finishing heat-cleaned fabric, is reduced greatly due to the presence of the starch, oil, and polyvinyl acetate that are required to obtain suitable handling characteristics in the fiber, but which are incompatible with the laminating resins. The coupling agents used are several water-soluble silane types and, also, methacrylato chromic chloride (6).

Attempts currently are under way at two manufacturers of glass yarns to eliminate the aqueous sizing

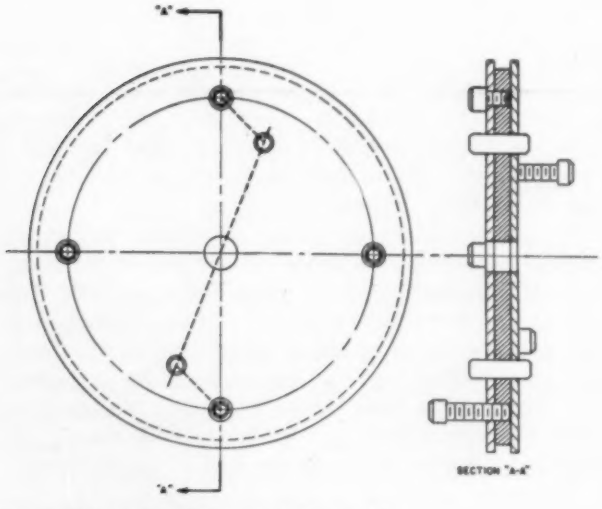

Fig. 2. Schematic diagram of ring mold.

systems by an application of the NOL-24 finish directly onto the fiber at the bushing. This finish, when applied to heat-cleaned fabric, has been demonstrated to be both an excellent coupling agent, as well as an effective protective lubricant for the fiber surface. There has been some work toward the application of fabric finishes to heat-cleaned roving that, at the time of forming, had been given the standard textile size (6). This approach has led to improved results over those obtained with roving having the reinforcement sizes. The improved results, however, are not what might be expected in terms of what has been accomplished with fabric finishes.

More development work needs to be done to determine the optimum methods of heat-cleaning and the aplication methods for the finishes themselves. This method of placing a chemical finish onto roving, unfortunately, also leads to a cost-per-pound about four times that for commercial-grade roving having the coupling agent combined with the size. Application of a finish to heat-cleaned roving, however, may be one feasible way of realizing the maximum potentials from these materials in terms of strength properties. For that reason, some work has been conducted at the Naval Ordnance Laboratory to place silane-type chemical finishes onto parallel roving in a manner similar to that used for glass fabric.

Survey of Literature

In order to ascertain the relative effectiveness of various finishes to be evaluated on roving at NOL, a reliable laboratory test method for use on parallel fiber-

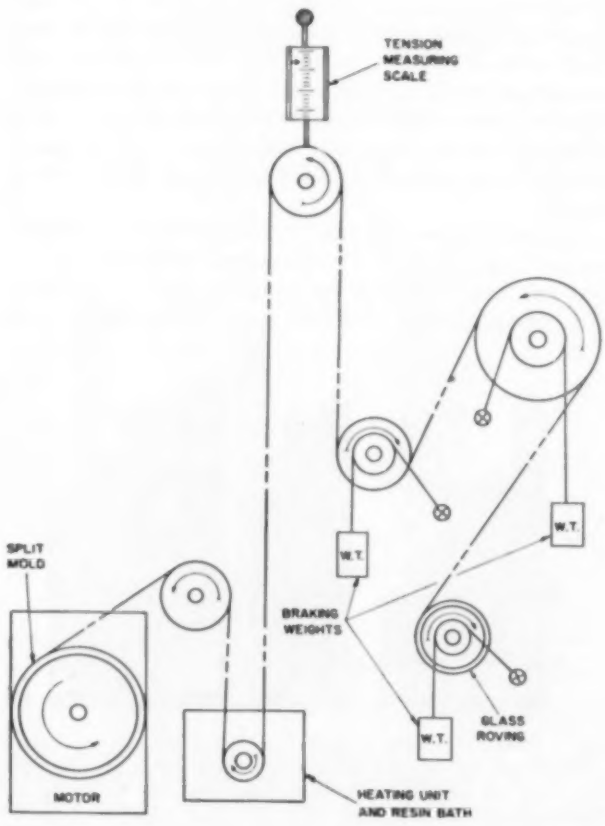

Fig. 3. Schematic diagram of winder components.

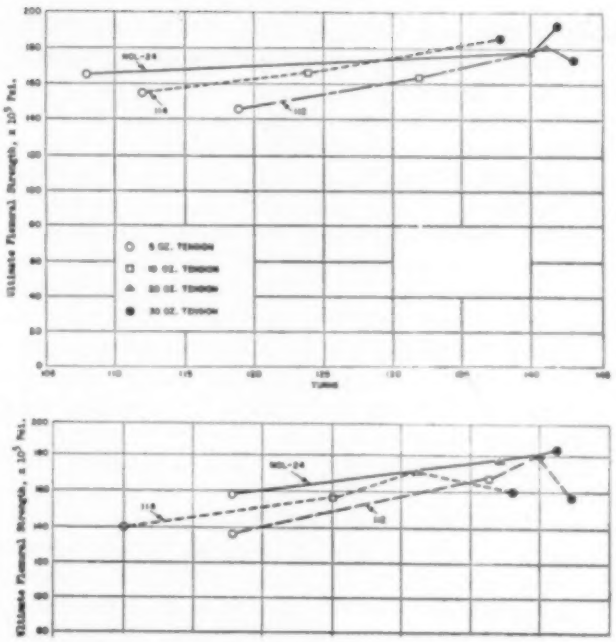

Fig. 4. Effect of various tensions on dry (top) and wet (bottom) ultimate flexural strengths with Epon 828 and CL.

reinforced plastics was needed. A survey of such methods was made. A paper in 1950 (7) described attempts to evaluate parallel glass-fiber mat in laminates with silicone, melamine, and polyester resins. Cross-plied parallel mat laminates were made with partially cured pre-impregnated stock, and there was difficulty with flow of fibers in the pressing operation. Flexural, tensile, and compressive data were given, but there was no attempt to propose the procedure for a test method.

A paper in 1952 (6) suggested a test method for the preliminary evaluation of performance characteristics of roving with reinforcing sizes, as well as chemical finishes. This method was based on the fabrication and flexural strength evaluation of a reinforced-plastics fishing rod. Flexural strength data under both dry and wet conditions with several sizes and finishes were reported. The data of that report showed dramatically the effects of different surface treatments on roving

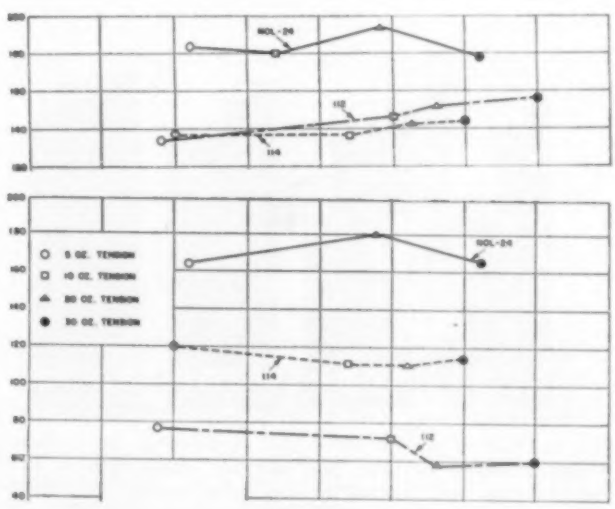

Fig. 5. Effect of various tensions on dry (top) and wet (bottom) ultimate flexural strengths with P-43 and DDM.

using a DAP-type polyester resin.

However, the reliability of the fishing rod as the basis for a sensitive test method is not helped by the fact that resin contents ranging from 60-73% were obtained on 10 rods fabricated by presumably identical methods. Nothing was said about agreement of data among specimens from the same rod, or reproducibility of data from rod to rod. Further, the method had been found workable only for DAP- and styrene-type polyester resins. The rod-like flexural test specimens offered very little bearing surface at the points of loading. Accordingly, it is to be expected that the bearing stresses at the mid-points of loading produce very high local effects that cannot be accounted for in the usual flexural formulas.

Furthermore, great difficulty was encountered in gripping a fish rod tip for a tensile test so as to avoid premature failure in the grips. The procedures did not include a method for the determination of inter-laminar shear strengths or inter-laminar tensile strengths of the specimens. The fish rod technique, however, was a useful and convenient laboratory tool, and the method was claimed simply as a good "preliminary evaluation" test.

A second paper offering a similar fish rod technique specifically as a test method came in 1953 (8). The details of the method of specimen fabrication and testing were given. The fabrication method differed in some respects from the previous one cited, but the end-product was a DAP- or styrene-type polyester rod. No data were given. In February 1957, it was reported that the method had been abandoned (10).

Another paper in 1954 proposed a hysteresis energy loss determination on fishing rod specimens as a technique for evaluating the effect of sizes in reinforced plastics (9). The authors found differences between the four sizes evaluated, but admitted that they never could get a uniform glass rod. These rods were made by the Owens-Corning Fiberglas method.

In 1954, there was reported the fabrication of parallel-fiber laminates for the evaluation of a new coupling agent that was added to the resin (10). The method of laminate fabrication and testing was given in detail, and was suggested as a method for production control.

Another paper, in the same year, reported development work on parallel-fiber mat (11). The mat was fabricated directly from the fiber-forming operation, thus by-passing the roving step. The mat was sprayed lightly with binder resin dissolved in solvent as it was made and the mat was partially cured later to permit handling. Cross-plied laminates were fabricated and tested in a manner quite similar to methods used for fabric.

A second paper from the same authors in 1955 reported an evaluation of several chemical treatments on the mat (12). The cross-plied polyester laminate still was the basis of the evaluation. The results were somewhat disappointing, possibly not as a result of test method, but from difficulties encountered in applying finishes to soda glass.

A third paper in 1957 reported evaluation of strength properties from the parallel mat by fabrication and testing of parallel-plied, rather than cross-plied, laminates (13). Emphasis was on evaluation of fibers from various glass formulations rather than the effects of fiber treatments. However, each new glass formulation led to at least somewhat different fiber surfaces (chemically) in a manner similar to different surface treatments on a given formulation-type glass fiber. Such an evaluation certainly would be complicated by effects stemming from variability at the resin-glass interface. This method, based on parallel mats, is limited in that it applies only to mat made by a particular method, and its use in finishes evaluation also becomes complicated by the binder system.

Work on torsion loading of a fishing rod as a method for the evaluation of the resin-glass bond in a parallel-fiber laminate has been reported. A total of 17 rods at four different lengths was tested. The failure was progressive in nature, so that the ultimate failure was without meaning. This test was found to be extremely sensitive to the strength of the skin, and it was almost impossible to fabricate rods without resin-rich surfaces. The test is possible theoretically, but was finally abandoned.

This survey showed that the state of test methods for the evaluation of roving surface treatments in reinforced plastics was limited in scope, and of questionable reproducibility and sensitivity. The fishing rod

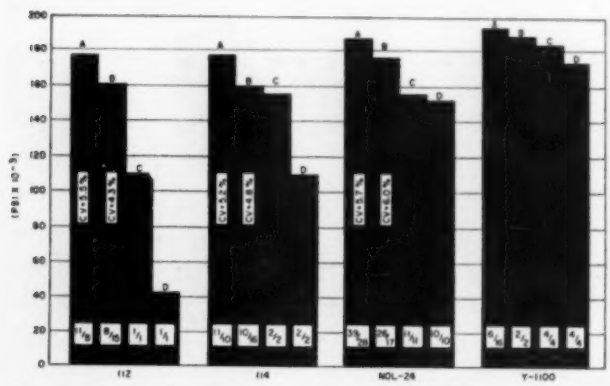

Fig. 6. Effect of various water boil conditionings on ultimate flexural strengths of Epon 828 and CL. Numerators in bar fractions show total number of specimens; denominators show total number of rings from which the specimens were taken. Conditionings: A—Standard (dry); B—Two hours water boil; C—Six hours water boil; and D—12 hours water boil.

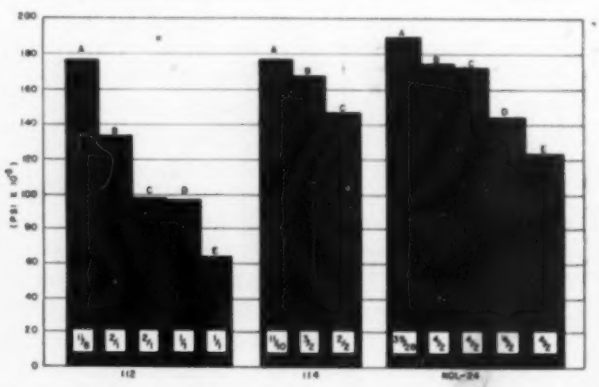

Fig. 7. Effects of various relative humidity & temperature cycle conditionings on ultimate flexural strengths of Epon 828 and CL. Meanings of bar fractions are the same as in Figure 6. Conditionings: A—Standard (dry); B—Two days in August; C—Four days in August; D—14 days in January; and E—28 days in January.

technique was limited in use to polyester resins, and it was reported that the rod specimens could not be tested in tension because of gripping difficulties. No test methods were found for the determination of the interlaminar shear and tensile properties of roving-reinforced plastics. The fabrication and testing of laminates made from parallel roving by a hand lay-up method looked even less attractive.

Test Method

Considering the needs at this Laboratory, NOL engineers decided to try another approach. It was believed that some type of test specimen might be simple and made reproducibly; would be more closely related to prototype shapes under development than a fishing rod-shape; and might yield data useful to the design engineer, as well as to the chemical finishes study group. The basis of the test specimens was a ring measuring six inches in diameter, ¼-inch in width, and ⅛-inch in thickness (see Figures 1 and 2). This was fabricated by drawing eight-end roving through a resin bath onto a split mold under controlled conditions of tension and temperature.

There are many advantages with the ring specimen from the fabrication standpoint. It is fabricated easily and quickly, and under relatively clean conditions. Duplicate conditions of fabrication from ring-to-ring are achieved easily so that reproducibility of specimens within the same ring, as well as from one ring to another, is excellent. The ring-winding apparatus, while not automatic, was designed to relieve the operator of responsibility for exercising critical judgment in many important details of the fabrication thus reducing the dependence of the technique on the individual operator. Epoxy and polyester resins have been used with equal success.

From the point of view of testing, there are many more advantages with the ring specimen than with a fishing rod-type specimen. A ring certainly is more closely related to structures of interest to NOL, such as tubes and spheres, than is a rod. Ring data already have been found useful to the designer. The ring specimen can be tested in tension since it can be gripped with suitable jigs. The tensile jig is shown as Item 7 in Figure 5. The ring also may be cut up into smaller specimens that can be tested in flexure or shear (see Items 5 and 6 in Figure 5). The static modulus of elasticity may be obtained on the entire ring, as well as from the flexural specimens cut from the ring.

A third advantage of the ring specimen is the flexibility available to the researcher. Roving tensioning is easily controlled over a range such that resin contents from 70-85% may be achieved after some experimentation with a good degree of accuracy. It is possible to vary the resin bath temperature from 76-200° F. The ring mold temperature also may be controlled to a certain extent; this is probably not too critical degree-wise, but still a factor in securing reproducible specimens. It also is possible to vary the rate of traverse of the level winding mechanism by a change of gear ratios so as to effect different wind-up patterns in the rings. This has not been investigated as yet.

Ring Fabrication

The device for the fabrication of rings was rebuilt several times before satisfactory specimens were produced. The framework was constructed from laboratory "Flexframe" stock. The apparatus now used is shown in Figure 3. The apparatus consisted of three parts: a tensioning device; a resin-impregnating bath assembly; and a mechanism for drawing and level winding the roving onto the mold.

The apparatus permitted tensioning of the roving from 2-30 ounces. This was accomplished without any observed fiber damage up to 25 ounces with heat-cleaned roving, and 30 ounces with NOL-24 treated roving. The resin-impregnation bath was heated electrically and could be kept at whatever temperature would give the best impregnation compatible with a sufficiently long, useful, resin working-life. It was possible, thus, to make consecutively up to six satisfactory rings with both polyester and epoxy resins by using only 250 grams of resin. The winding apparatus consisted of a small motor, a gear reducer, a counter, and a level-winding

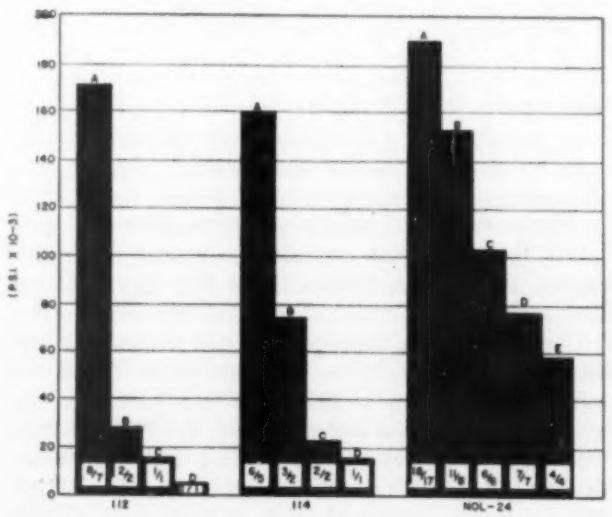

Fig. 8. Effects of various water boil conditionings on ultimate flexural strengths of P-43 and DDM. Bar fractions as in Fig. 6. Conditionings: A— Standard (dry); B—Two hours boil test; C—Four hours boil test; D—Six hours boil test; and E—12 hours boil test.

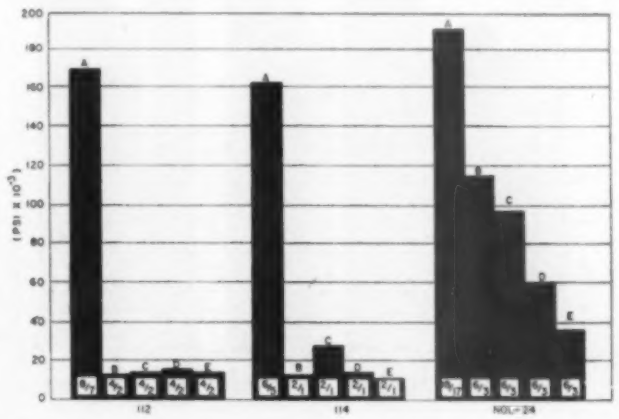

Fig. 9. Effects of various relative humidity & temperature cycle conditionings on ultimate flexural strengths of P-43 and DDM. Bar fractions as in Fig. 6. Conditionings: A—Standard (dry); B—Two days in Feb.; C—Four days in Feb.; D—14 Days in Jan.; and E—28 Days in Jan.

mechanism. The mold speed was six rpm. The impregnated roving was drawn into the rotating mold in a uniform fashion by the level-winding guide.

Preliminary Work

In the early stages of experimentation with fabrication of the ring, many problems were encountered. Several of the molds became slightly warped owing to difficulty with the ring release. This resulted in yawing on the winder so that it was not possible to fill the mold uniformly with the level-winding device. It finally was found that Teflon coating of the mold solved the release problem without damage to either ring or mold. Many practice rings were made before a satisfactory method of roving tensioning was found. The number of turns that would just fill the mold was not only dependent on tension but, to a small extent, also on mold temperature. A uniformly flat outer surface on the ring is necessary to get a uniform ring thickness.

A clamping technique finally was adopted in which a Teflon-coated steel strap was drawn against the wet lay-up and tightened up across the face of the mold (see Item 3 in Figure 1). This arrangement was satisfactory provided that the mold was wound just full. The number of turns would vary by 2-3% on successive identical rings, so sharp observation was necessary to ascertain the end of a winding. The differences in the required number of turns could stem from various causes, such as small variations in the tension, in the roving itself, and in mold temperature.

Tensioning Studies

Once a satisfactory appearing ring had been made, several were wound at roving tensions ranging from 2-30 ounces with epoxy and polyester resins, using three finishes. This study was made to determine the number of turns for each resin system that would yield the

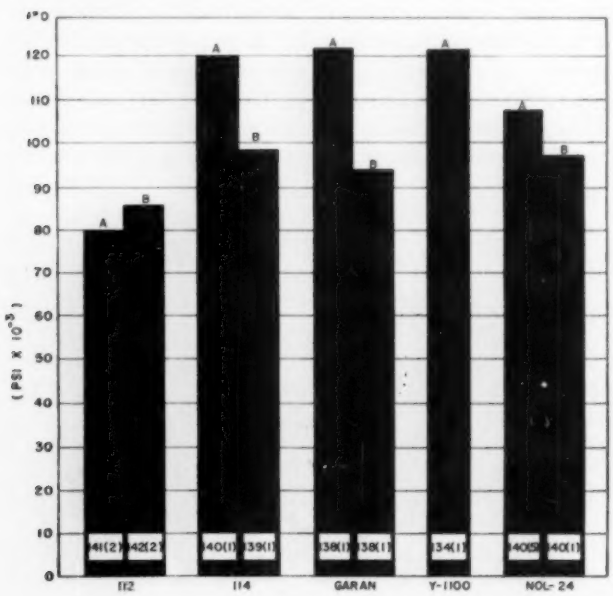

Fig. 10. Effects of water boil conditionings on tensile strengths of Epon 828 and CL made with various finishes. Conditionings: A—Standard (dry); and B—Four hours water boil. Numbers in bars show the number of turns of roving in the test ring, and the numbers in parentheses show the number of rings tested.

greatest sensitivity to fiber surface treatment. In Figure 4 are shown ultimate flexural strength data from both dry and wet specimens made using Epon 828 and curing agent CL. The "wet" data were obtained after two-hour conditioning in boiling water.

Generally, these data show that the ultimate flexural strength increases with the number of turns, as would be expected. It may be significant that with finishes 112 and 114 after two hours in boiling water, the strengths decrease as winding tension is increased from 20-30 ounces, while that for NOL-24 increases. The ash content varied from 74% at five ounces tension to 83% at 30 ounces. The sensitivity of strength to finish actually appeared greater at lower winding tensions.

In Figure 5 are shown analogous data from DDM-cured polyester rings. Specimens were tested both after standard conditioning (upper) and after a two-day conditioning routine of temperature and humidity cycling (lower). The sensitivity of ultimate flexural strength upon the number of turns in the ring (winding tension) appears to be less, and a winding tension of 30 ounces is beyond the optimum for NOL-24. The data from the relative humidity and temperature conditioning (lower) show the tremendous effect of finish at all tensions. The ash content varied from 76% at five ounces tension to 84% at 30 ounces.

At the time this work was done, the control on the tensioning was still giving some difficulty. The results shown in Figures 4 and 5, therefore, should be considered in a qualitative sense. The data are sufficiently reliable, however, to conclude that a future winding tension of 20 ounces would be satisfactory, and that severe environmental conditionings were required to emphasize the effects of fiber-surface treatment.

It was very difficult to maintain 30 ounces of tension to within ±6 ounces. There was no significant increase in glass content over that achieved with 20 ounces of winding tension, and end-breakage occurred with both the 112- and 114-treated fibers. A winding tension of 20 ounces, therefore, was selected for future work. As the work progressed, further refinements in the tensioning control were achieved so that, ultimately, a control to ± 2 ounces was possible.

Ultimate Flexural Strengths

In the preliminary studies with different winding tensions it was found that ultimate flexural strengths from ring specimens seemed to be less sensitive to the effect of finish than were laminate specimens made from fabric. In Figure 6 are shown data obtained on flexural specimens with four finishes tested both dry and after two, six, and 12 hours conditioning in boiling water.

Consider first the strengths obtained at standard condition and after two hours in boiling water. Finish 114 was only equivalent to finish 112 (heat-cleaned). The wet strength retention with finish 112 was 89% whereas with Epon 828/CL laminates using 181-112 fabric, the best wet strength retention obtained at NOL is 81% (4). Specimens fabricated with NOL-24 and Y-1100 finished roving appeared to be only slightly superior to those from 112- and 114-finish roving.

This lack of sensitivity to finish under test conditions analogous to those generally used for fabric laminates

was surprising. Several explanations were considered. The curved flexural specimens not being equivalent to flat specimens might be a factor. It was possible that finishes 114, NOL-24, and Y-1100 had not been applied as effectively to the roving as to glass fabric so that no great improvement over the 112 treatment should be expected. Owing to the efficient packing possible in the ring, glass contents were roughly 15% higher than in fabric specimens. This could lead to such a highly impervious structure that moisture during the two-hour boiling conditioning might not penetrate to the resin-glass interface in any substantial portion of the specimen. If this were so, then the dry and two-hour boil tests would be expected to reflect mainly cohesive resin failure, rather than adhesive failure at the resin-glass interface.

A careful consideration of these factors was made. No good reason could be seen why a curved specimen would mask the effect of finish. Neither did it seem reasonable that relatively nothing had been accomplished by these finish applications to the roving, even if not carried out in the best manner. The observed lack of sensitivity to finish, however, could be explained if it were assumed that the failure was cohesive in the resin, rather than adhesive at the resin-glass interface.

The ultimate flexural strength data in Figure 6 under conditions A and B were obtained from specimens with four different finishes, but the resin system used was the same for all. The fact that the strength differences between finishes were so small could mean that the test under these conditions was an evaluation of resin, rather than finish. If this were true, then even after two hours in boiling water the data would indicate that the interfacial adhesive strength was still greater than the cohesive resin strength. All this would imply that ultimate flexural tests carried out on ring specimens conditioned in the manner of fabric laminate specimens would be useless for an evaluation of roving finishes.

It was found, however, that the flexural test could be made sensitive to finish on the basis of assumptions made above. Simply by more severe environmental conditioning of the specimens prior to testing, a very dramatic picture of flexural strength dependence on finish was shown. Extended periods of boiling in water and very severe humidity-temperature cycle conditionings later were carried out on specimens. This treatment presumably did result in moisture penetrating the dense, highly-packed specimen to degrade the resin-glass bond. It was assumed that at some point in the extended conditionings, the failure at test would switch from cohesive to an adhesive type.

After six hours boiling, the relatively high strength still in the specimens with heat-cleaned roving could mean that the moisture had not yet penetrated the specimen completely, and the failure under this condition might be both adhesive and cohesive. After 12 hours in boiling water, finish 112 retained only 23% of the standard condition strength, finish 114 retained 61%, NOL-24 retained 82%, and Y-1100 retained 88%. The range of ultimate flexural strength values after 12 hours in boiling water varied from 42000 psi. for 112 to 174,000 psi. for Y-1100.

In Table 7 are shown somewhat limited ultimate-flexural data obtained with Epon 828 and CL after accelerated cycling. A comparison with the data in Table 5 shows that the four-day cycle is considerably more severe than the two-hour boil conditioning, but is not nearly as effective in evaluating a finish as the 12-hour boil conditioning. Ultimate flexural strength data also were obtained after conditioning the specimens for 14 and 28 days in the standard JAN relative humidity and temperature cycle. The data were very limited and were obtained only with 112 and NOL-24. After 28 days, the strength with NOL-24 was 79% of that after 12 hours in boiling water at a level of 122,000 psi. The corresponding strength with 112 finish was 150%, but at a level of 63,000 psi.

The data from Figures 6 and 7 showed that to have a test method for finishes based on the flexural test, severe specimen environmental conditioning was needed. From the standpoints of effectiveness, speed, convenience, and cost, the 12-hour conditioning in boiling water is the best.

In Table 6 also are shown the coefficients of variation obtained after standard and two-hour boil conditionings on up to 29 specimens cut from up to 28 different rings. These ranged from a low of 4.3% on eight specimens from five rings to 6.0% on 26 specimens from 17 different rings.

Relatively little sensitivity to finish was shown by the ultimate flexural test with the polyester ring under standard specimen conditioning. After a two-hour period in boiling water, however, the polyester ring specimens showed very great and predicted differences in strength as a result of different finishes. These data are shown in Figure 8, as well as those obtained after (in the case of NOL-24) 12 hours boiling. After six hours in boiling water, the ultimate flexural strengths with 112 and 114 were less than 18,000 psi., while NOL-24 still had a strength of 58,000 psi. after 12 hours boiling.

Figure 9 shows ultimate flexural data obtained on similar rings after accelerated relative humidity

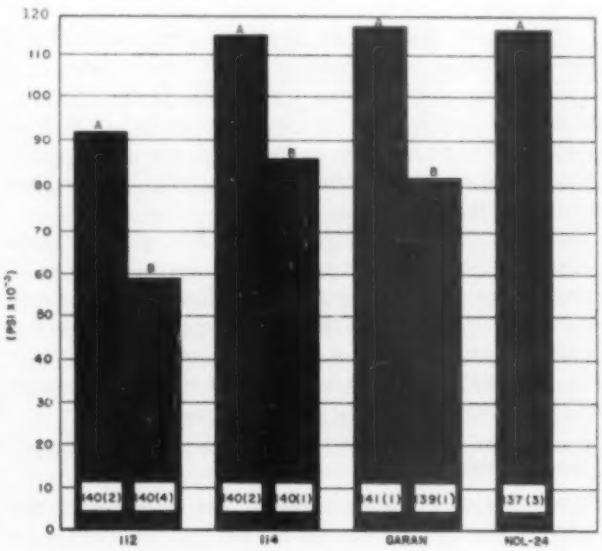

Fig. 11. Effects of water boil conditionings on tensile strengths of P-43 and DDM made with various finishes; Conditionings: A—Standard (dry); and B—Four hours water boil. Numbers in bars as in Fig. 10.

and temperature conditioning. The short cycle was severe on all finishes, but NOL-24 had three times the strength of 114 after four days of conditioning. The extended (JAN) cycle was even more severe, as the data show in bars D and E. After 28 days, even NOL-24 fails very badly.

The data in Figures 8 and 9 show that much less drastic conditioning is needed with polyesters than epoxies to bring out the effect of the finish. A two-hour period in boiling water easily separates the good finish from the poor, and a four-hour period probably would be adequate to get a good comparative evaluation of several very good finishes. There is, therefore, no need of employing complicated, time-consuming, and expensive conditioning procedures to bring out the effect of finishes on strength properties with polyesters studied in this report. More water-resistant polyesters could conceivably require more rigorous conditioning.

Tensile Data from Rings

Figure 10 shows tensile strengths obtained on epoxy resin rings with five different finishes. The data are limited in many cases to one value. Finishes 114, Garan, and Y-1100 are about 10% better than NOL-24 under standard (dry) conditions. After a four-hour period in boiling water, however, 114 had lost 18% of its strength, Garan had lost 23%, and NOL-24 had lost only 10%. The ideal conditioning must be discovered to bring out the effect of finish in the tensile test with epoxy resin rings. Tensile testing does not reflect the quality of the finish as much as it does the tensile strength of the fiber.

In Figure 11, we see analogous tensile data obtained on rings fabricated with P-43 using a low-temperature cure. As before, the effect to finish is masked under standard-conditioning testing, but there seems to be a predicted pattern of behavior after four hours in boiling water. Possibly the rings should be boiled for six or even 12 hours before testing. Again the data are very limited, partially because each test consumes a whole ring.

The tensile test, when finally worked out, should give valuable information on the protection against fiber self-abrasion within the plastic that the finish provides because of its lubricity, rather than its bonding properties. The property of the finish might better be evaluated in the stressed plastic, rather than in the dry yarn or fabric.

Many of the data in Figures 10 and 11 were obtained on rings with variations up to 10% in the number of turns. Some of these were made before the better tensioning control was achieved. The data, therefore, should be considered in a qualitative sense at this time. The data do indicate, however, that more severe conditioning must be tried.

Conclusions

The literature survey showed that quantitative test methods for the evaluation of strength properties of parallel glass fiber-reinforced plastics were practically nonexistent. The test methods had failed mainly from difficulty in securing satisfactory test specimens.

It was found that a small ring could be fabricated easily, inexpensively, and reproducibly from roving using polyester and epoxy resins. The apparatus for the fabrication of this ring can be built in the laboratory, and the details of its construction and operation are given.

The ring specimen offers a triple approach to the problem of evaluation of surface treatments on glass roving for use in reinforced plastics. Segments of the ring may be tested in flexure or shear, and the entire ring can be tested in tension or flexure. The specimen also appears adaptable to the measurement of the internal damping coefficient.

The details of the flexural test have been worked out for polyester and epoxy resins to the point that a test method sensitive to fiber finish now is available both as a research tool and for quality control purposes. The degree of reliability of the data is satisfactory. As an example, a 6% coefficient of variation was obtained on 26 specimens from 17 different rings. The proper environmental conditioning (wet) must be considered as an integral part of the test.

The environmental conditioning requirements for the tensile test to be sensitive to finish have not been determined, but the work is continuing. The shear test, as carried out, was shown to be qualitatively sensitive to finish. It is believed that certain modifications and refinements in this test will improve it considerably.

Bibliography

(1). H. A. Perry, Jr., "Criteria for the Cost, Weight and Bulk of Structural Materials." Paper Presented at the SPI Reinforced Plastics Div., Atlantic City, N. J., Feb. 7, 1956.

(2). **Chem. Eng. News**, p. 122 (Feb. 18, 1957).

(3). P. W. Erickson, I. Silver and H. A. Perry, Jr., "Universal Type Chemical Finishes for Glass Fibers Used in Reinforced Plastics." Paper presented at the SPI Reinforced Plastics Div., Kansas City, Mo., March 1954.

(4). P. W. Erickson and I. Silver, "Summary Report on NOL-24 Finish on Glass Cloth." Paper presented at the SPI Reinforced Plastics Div., Chicago, Ill., Feb. 7, 1957.

(5). L. M. Calhoun, "Glass Fabric Finishes vs. Fiber Sizings," **Modern Plastics**, 32, 2, 132 (Oct. 1954).

(6). L. P. Biefield and T. E. Philipps, "Surface Treatments for Fibrous Glass." Paper presented at the SPI Reinforced Plastics Div., Cleveland, O., Jan. 10-12, 1950.

(7). J. Plummer, "Unwoven Parallel Glass Fibers and Silicone Laminates." Paper presented at the SPI Reinforced Plastics Div., Cleveland, O., Jan. 10-12, 1950.

(8). A. Fox and J. G. Mohr, "A Proposed Test Method for Determining the Effect of Sizes on Glass Fibers for Reinforced Plastic Laminates." Paper presented at the SPI Reinforced Plastics Div., Washington, D. C., Feb. 20, 1953.

(9). G. W. Bainton, Jr., C. J. Guare and K. N. Mathes, "New Evaluation Technique for the Effect of Glass Sizings on Glass Reinforced Plastics" Paper presented at the SPI Reinforced Plastics Div., Chicago, Ill., Feb. 5, 1954.

(10). J. H. Plummer and C. F. Newmeyer, "A New Coupling Agent for Glass Fiber Roving Polyester Products," **Ibid.**

(11). J. W. Case and J. D. Robinson, "Parallel Glass Fiber Laminates and New Resin Bonding Techniques," **Ibid.**

(12). J. W. Case and J. D. Robinson, "Pilot Production of Parallel Glass Fiber and Evaluation in Reinforced Plastic Application." Paper presented at the SPI Reinforced Plastics Div., Los Angeles, Calif., Feb. 8, 1950.

(13). J. W. Case, A. L. Houze, J. F. Brossy and A. Lasday, "Improvement of Reinforced Plastics by Fibers and New Glasses." Paper presented at the SPI Reinforced Plastics Div., Chicago, Ill., Feb. 7, 1957.

—THE END

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Controlling Profits in the Molding Plant

How costs for materials, labor, and various forms of over-head affect total plant costs and, in turn, molding profits

THE competent plastic molding plant manager must know the basis on which his products accumulate costs. He should have a firm grasp of the principles of cost control. If he does not thoroughly understand these fundamentals, he is at the mercy of others who will decide these important questions for him. Furthermore, lack of this knowledge will not permit him to discuss this question intelligently with his staff, and may allow an over-zealous sales staff to dictate selling prices.

It is axiomatic, from a business standpoint, that molded parts must be priced to sell at a profit. Selling prices are determined first by the cost of manufacture and, second, by the cost of distribution. These factors establish the profit realized at a given selling price. In the molding business, competition is keen and it becomes the duty of every manager to understand both of these factors in the operation of his business. Similarly, it is incumbent on the molding plant accountant to run the machinery of accounting so that these factors are presented regularly to management for their use in control of the business.

The manufacture of any commodity requires the application of the three prime cost components, and the successful molding of plastics is no exception. A molding plant must have raw materials, labor to mold the parts, and various forms of over-head in order to conduct the business. These factors, when combined, comprise the basis on which profits are built. However, there are two types of profit; one is the amount arrived at on the estimate sheet, and the other is the actual profit realized on the basis of production experience. In order to maintain a control on profits, the plastics manager must keep in close touch with actual experience and not be tempted to accept figures appearing on the original estimates.

Although quotations on molded parts are based on estimates, all such figures should be arrived at as a result of past experience. In the molding industry, it will be found that marked differences exist between one custom molding plant and another in prices quoted on

identical items. This indicates that an examination of the cost components might disclose where these divergencies come.

Material Costs

The price paid for molding compounds varies slightly from one molder to another. This difference is usually only a few cents per pound, depending upon the respective quantities ordered. Price gradients on virgin materials are based on total quantities per order rather than on an annual volume basis. Therefore, the larger molding plants do not hold much advantage over the smaller ones so far as material costs are concerned.

In competitive quotations on identical parts, the same amount of raw material will have to be ordered, regardless of who quotes on the work. The only exception to this condition will be found in instances where a molding plant uses large quantities of a certain material that is common to many different items being run in the same plant. For example, an injection molding concern might specialize in the molding of nylon parts, both proprietary items as well as custom molded parts. A concern such as this would have a material price advantage over another molder who might have to quote on parts where the volume was not large. The latter company would have to pay a higher price for his raw material because of the relatively small quantity of powder required.

Other examples of material price differential are found where reprocessed materials are acceptable. Thermoplastic molded parts present a different picture because of the wider selection of raw materials available. There are no such compositions as reprocessed thermosets, nor are there any reground thermosetting compounds on the market. Since the thermoplastics can be molded from so many different formulations, opportunities exist for variations in molded part quotations. Quoted figures on any specific job could be based on use of any one of three classifications of the same type of material. The inexperienced buyer might not inquire whether the molded parts were made from virgin, reprocessed, or just reground materials. In the majority of cases, however, quoted prices on molded parts are based on the use of specifically-named raw materials. Consequently, the material price differential should remain fairly consistent insofar as competitive prices are concerned.

One very important source of material price variation on the quotation sheet will be found in the different bookkeeping methods employed. For instance, one firm will add the cost of making the preforms to the price of the raw materal. Another concern will include preforming as a direct labor charge, and apply the cost under the heading of direct labor. A similar situation will be found in the thermoplastic field. Whereas some companies figure their raw material price as nothing more than the net weight of the piece multiplied by the cost per pound of the material, others will include the estimated amount of material in the sprues and runners.

Estimated costs of thermoplastic materials also vary from one plant to another with regard to the grinding operation. Some concerns operate special grinding departments, whereas others utilize individual granulators at each machine. Thus, differences in material costs may be quite apparent from one plant to another insofar as the cost sheet is concerned.

Labor Costs

In the average molding plant, the greatest percentage of labor expense usually is found in the molding operation. Other labor costs are incurred by finishing operations, as well as the necessary inspecting and packing expenses. The question then arises as to how these costs will differ from one factory to another. Of course, different wage levels exist depending upon the geographical location of the plant, but this is an economic condition that is not controllable readily by local management. Aside from this consideration, there are many other conditions within the respective molding plants that contribute to variations of labor costs.

In the compression molding field, the type of equipment owned by the molder plays an important role in the cost for producing his parts. Equipment refers not only to the molding presses and dies, but also to the auxiliary machines. Possession of such accessories as preforming machines, preheaters, tumbling barrels, and other automatic components, has a direct bearing on total labor costs.

The margin between profit and loss in the production of certain parts often may be governed by the type of presses being used. In fulfilling requirements on very small molded parts involving exceptionally large volume; for example, fully-automatic presses will entail less labor cost than will semi-automatic machines. Also, a molding plant which does not happen to own transfer molding equipment often will find it difficult to compete on parts where a transfer-type mold is the most practical. In such cases, the saving in labor will relate to the reduction in finishing operations, rather than to actual molding costs.

Injection molding costs are not too susceptible to wide variations within the industry, chiefly because the injection molding process is quite similar, regardless of the type of press utilized. Admittedly, the molder who owns vertical plunger machines will have a certain price advantage over his horizontal-press competitor when they both quote on the same insert job. Fast-closing presses likewise will produce parts much more cheaply than do slower-closing counterparts.

Auxiliary equipment plays only a minor role in injection molding. All thermoplastics should be preheated, and all injection-molded materials must be regranulated. The use of feed-hopper dryers may reduce labor costs to a certain extent, but much of the saving realized will be found in indirect, rather than direct, labor. Mold temperature-control units used for heating or chilling the molds are necessary adjuncts to efficient molding; therefore, have no direct bearing on competitive cost figures.

In any inter-plant labor cost comparison, differences in the size of molds must be mentioned. Naturally, if the selling price of a certain molded part were to be figured on both a 20-cavity as well as on a 10-cavity mold, the labor cost will be less on the larger mold. This is a point that requires no further discussion, inasmuch as mold capacities customarily are stated on

the quotation sheet. Cure time, cycle time, and other molding conditions determine the total cost of molding. These factors will be found to vary considerably from one plant to another, depending to a large degree on the efficiency of operation.

Over-head Costs

The services required to produce goods are looming ever larger on the average cost sheet. Services, perhaps better known as burden, over-head, indirect labor, non-productive labor, etc., are becoming the most important components on the cost sheet. It is these constantly-expanding expenses that often dictate the difference between profit or loss on the annual statement of a plastics molding firm.

Although over-heads are computed on a theoretical basis, they are just as actual, certainly as important, as the costs of materials or productive labor. However, it is this component of the cost sheet that apparently disrupts any semblance of uniformity in the comparative costs of molded parts. In some plants, over-head expense is applied as low as 50%, while in others this figure may run as high as 400%. It is evident that the various methods used in determining the correct percentage of over-head may be the cause of wide differences in selling prices.

If the average molder wants to obtain accurate over-head figures and can overcome the tendency subconsciously to deceive himself, he can do so with little additional bookkeeping effort. Such accomplishment requires merely a thorough knowledge of the indirect labor, materials, depreciation, and other contributing elements entailed in the determination of services. Unfortunately, there are many pitfalls likely to be encountered in attempting to arrive at a reasonably accurate over-head percentage. If these can be recognized and overcome, the way will be cleared for the preparation of a much better profit-and-loss statement. It must be realized that even though an over-head figure has been definitely established, this percentage changes from year to year, month to month, and even from one day to the next. Of course, it is not good practice to change the rate too often, but frequent check-ups should be made in order to estimate correctly on all new work.

Depreciation plays an important part on the accounting sheet. Molding presses, preform equipment, rolling barrels, and other heavy machinery must be given first consideration. If the company makes its own molds, then the various lathes, duplicators, and other such equipment must be counted also. Where proprietary items are manufactured, there is an investment in expensive dies. In most cases, the rate of depreciation is quite high on these molds. Some concerns include amortization as a separate part of the estimate sheet, whereas others assume the rate to be included in the over-head. The only danger in the latter method lies in the possibility of forgetting to include all the amortizations, or perhaps of spreading the rate over a longer period than is actually the case.

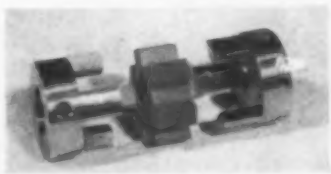
Molding plant maintenance is perhaps the next most-neglected burden. Expensive machines require adequate up-keep. Both compression and injection molds undergo a constant strain as a result of the high pressures used in producing the parts. Depreciation or amortization reserves take care of normal wear, but broken pins, occasional needs for shimming of cavities, packing repairs, and many other such incidentals constantly are arising. Provision must be made for these expenses. Break-downs in auxiliary equipment are the means of added indirect expense. Repairs often are required on preform presses in the compression department, and granulating machines must be kept in operating condition at all times.

Many different methods of computing over-head are employed. Some plants apportion fixed charges to each machine, while others subdivide in accordance with the floor area utilized. Many firms distribute the load as a ratio of total productive hours. Regardless of the method used, the fact remains that the ratio of indirect labor and material to direct labor will determine the percentage of over-head in the plant. The way in which these components are distributed is not nearly so important as making sure that all expenses are included. No intricate cost system is needed to obtain all of the three basic cost components, and it is not difficult to arrive at some very definite over-head ratios once a system has been established.

Conclusions

To facilitate the work of checking estimated costs with actual costs, the use of a form sheet is recommended. This sheet consists of two columns, one with the estimated cost and the other with the actual cost based on an average production run. Use of a cost-estimate comparison sheet will disclose immediately any marked differences. Conditions causing any such disparity then can be checked and rectified. If it is found that the molded parts cost much more than anticipated, an immediate investigation can be made into the causes. Comparison sheets are not only helpful in following production costs, but also are essential to efficient operation of the plant. There are, of course, many other very important ramifications to cost control, but closer scrutiny of actual costs and their relationship to preliminary estimates will go far toward controlling profits in the molding plant. —THE END

Eco non-corrosive shaft coupling.



Shaft Coupling for Corrosive Use

A stainless steel, flexible shaft coupling with glass-filled Teflon spider seems to fill the bill in corrosive atmospheres. Called the Eco 316, the coupling is available from Eco Engineering Co., Newark, N. J. Standard bore sizes from ¼-¾ inch are stocked; however, any size combination can be obtained. —THE END

PLASTICS TECHNOLOGY

EXPLORING FABRICATION TECHNIQUES

By L. J. ZUKOR, *Engineering Editor*

Widespread Interest . . .

. . . is being exhibited in blow molding by a great portion of the plastics industry. This interest stems from the phenomenal growth in the use of plastics for hollow ware such as light-weight toys, bottles, and other containers for liquids and semi-liquids. The squeeze bottle and other unbreakable containers are now well established on the American scene. These units have, in all instances, won approval from both housewives and industrial users.

To many extruders, this market appeared closed to them forever by the great patent wall built up by companies specializing in the blow molding field. The specialists were the assignees of patents for machinery required by the manufacturing process. Since the specialist companies were in the business of supplying hollow ware and not in the machinery business, the machines were kept captive for many years.

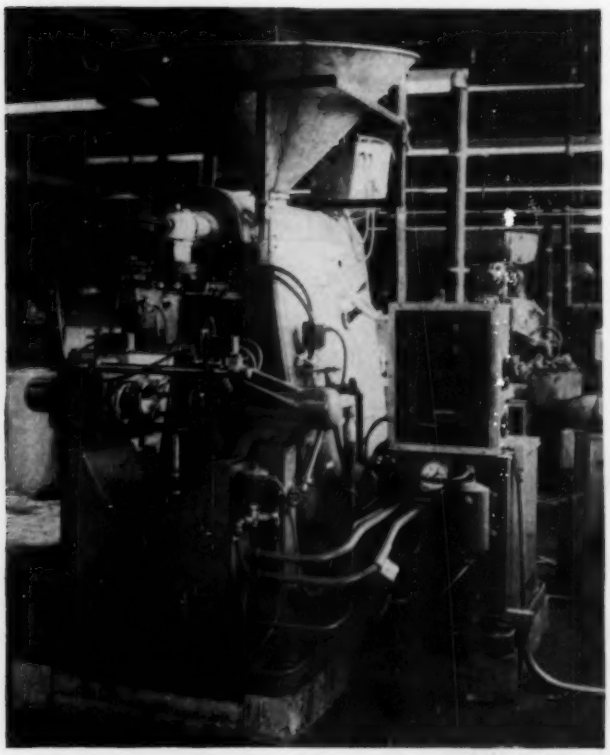
A change in policy has come about, whereby machinery manufacturers are being licensed or have patent rights assigned to them that permit the manufacture of the specialized machines. These newly manufactured machines are presently available to the plastics industry.

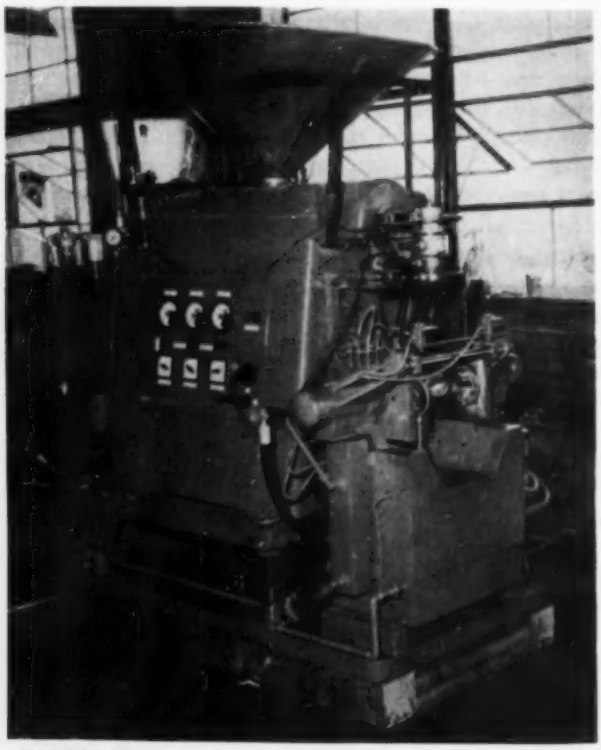
A blow molding machine incorporating an integral extruder is offered to the plastics industry by Kautex U. S. Sales Corp. It made its appearance to the industry at the recent 1958 National Plastics Exposition in Chicago. Basically, this is an automatic machine for blow molding plastic material and not an attachment that is used with existing equipment. (See our August issue, page 735).

In operation, the machine was observed to be highly versatile, with a completely automatic cycle controlled from an instrument panel.

At the Exposition, the distributor stated that the machine would be available in two sizes: one, for all small moldings up to and including a two-gallon container; the other, for the 1-20 gallon sizes. The machine members appeared to be ruggedly constructed and the over-all design predicated on continuous operation.

Machinery of this type allows a plastics manufacturer complete freedom in the design of ingenious molds. Both tandem and multiple cavity molds are entirely possible.





Photos courtesy: Kautex U. S. Sales Co.

Side Register Control . . .

. . . for presses, cutting machines, and all process machinery which operate on continuous webs, are mechanisms that are available as integral units on many machines, or as separate auxiliary members that can be incorporated on existing machinery. Web margin control on modern high speed machinery must have the ability to hold the web edge in position to a very close tolerance and be able to correct a deviation instantly without hunting, even when variations occur at high frequency. Although there is no standard, a tolerance of ±0.010 inch from a fixed position is considered ample for most applications. Whenever a tolerance below this figure is specified, the cost of the machine or attachment increases sharply.

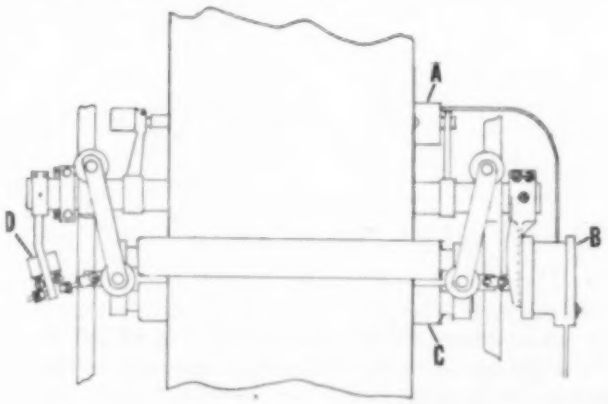


Diagram courtesy of The Huck Co.

Many types of mechanisms are available to the plastics industry, some basically mechanical and others electronic in operation. Both types make use of an air-operated sensing unit. Manufacturers who work with web materials recognize the importance that reliability plays in any control mechanism. A mechanism that is erratic or that periodically needs manual attendance cannot be tolerated.

When a manufacturer is concerned with the purchase of this type of equipment, he should consider the following salient points in his evaluation: the specific tolerance on the different web materials that will be serviced by the control (this will differ with material width, thickness, velocity, and type); ease in threading; ease in maintenance; and method of lubrication (proper lubrication tends to reduce breakdown, thereby reducing downtime on the complete machine).

Whenever possible, the manufacturer should request a demonstration to see the unit in operation on similar machinery, operating on a roll or rolls of material that he will be using in his own plant.

To explain the basic principle of web guide control, a brief description of the Huck "Sidelay" pneumatic unit follows:

The web edge passes over an adjustably mounted sensing head orifice (A). The pressure of the escaping air at this point controls a four-way valve in cylinder (B) which, in turn, controls air pressure acting on a piston within the cylinder. This piston moves the adjusting roller (C) sideways to maintain correction.

As long as the web covers three-quarters of the sensing orifice, the air pressure remains constant on both sides of the double acting cylinder. If the web moves sideways in either direction, the escaping air pressure will vary. This changes the position of the four-way valve, thereby increasing the pressure on one side of the piston and decreasing it on the other side. The correction rollers move (both angularly and axially) to restore the edge of the web to its original position over the orifice.

If the unit requires a correction of more than 0.1-inch, the micro switches (D) signal the rollstand to bring the web back into the control range. When a rollstand is not equipped to move sidewise by power, the micro switches are connected to indicator lights and a bell or buzzer to signal the operator who, in turn, makes the required change in rollstand position.

●

Preplasticizing Units . . .

. . . in injection molding have, since their inception, increased the output of most large capacity machines. Injection molding machines with capacities in excess of 120 ounces are usually equipped with various presoftening devices designed to feed plasticized material directly to the injection cylinder. Proponents of a preplasticizing system claim that such units provide shorter molding cycles, lower injection pressures, and increased homogeneity of plastic material and coloring matter. In the case of an externally mounted preplasticizer, such as the Watson-Stillman type, the material is fed to a heated cylinder that includes an internally heated torpedo. Other types of preplasticizers feed molten material into an insulated, but unheated injection cylinder which is used only to measure the quantity of material and to fill the mold.

A machine has recently been introduced by the Italian firm Fabrica Italiana Machine Stampaggio ad Iniezione of Milan. This machine, unlike any now in existence in the United States, is provided with a coaxial type preplasticizer in the form of an extruder screw. In reviewing the diagram, it can be seen that a head of this type lends itself to a multiplicity of uses. First, it could be an injection head; secondly, it could be an extruder head; and thirdly, it would be ideally suited for such operations as blow molding, or high pressure filling and potting.

In operation, the automatic metering of the material is effected by the screw which, by means of speed variation, introduces a measured quantity of plastic into the injection cylinder. The injection plunger then moves the plastic material into the mold.

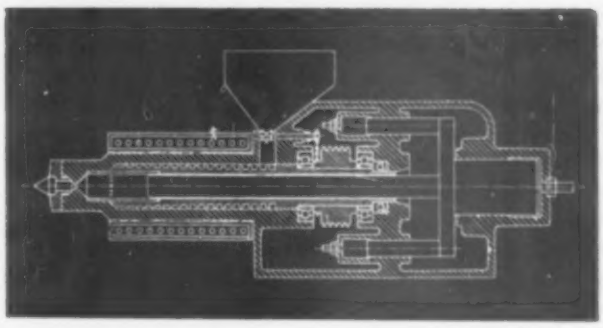


Diagram courtesy of Materie Plastiche

Edited by:
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Reinforced Plastics

The Problem of Government Bids

THERE appears to be a growing awareness among many lawmakers, newspaper editors, and prominent businessmen that Government buying policies should be reviewed and, in some cases, readjusted. With this, I heartily agree. Most reinforced plastic molders are old hands at dealing with the maze of technical and legal requirements imposed by Government purchasing. This is only natural in a field which owes so much of its beginnings to the various government agencies which, for so long, were the only interested customers, due largely to the high cost of the materials then in use.

All of us know the Government as a fickle sweetheart. Often, we have labored long and mightily on a prototype, only to lose the hoped-for production order to a still lower bidder. Such an experience generally leads us to condemn the system of purchasing which limits the placement of orders strictly to low bidders, without proper weight being applied to other factors.

I understand that the Subcommittee for Special Investigations of the Committee on Armed Services of the House of Representatives recently reported that negotiated contracts are evil. With this premise, I certainly do not agree. Most Government contracts **are negotiated!** The advertised bids are less than 5% of total Government business! I think that if viewed from the manufacturer's angle, this small percentage would also be eliminated.

What's wrong with negotiated contracts? Sure, once in a blue moon, some skullduggery will occur, but I believe the savings, even including the occasional skullduggery, would be plentiful. Nobody seems to measure the cost to the Government of preparing detailed specs, drawings, invitations, etc., nor the cost to the manufacturers, both competent and incompetent. Imagine the dilemma of the manufacturer confronted with the necessity of preparing a competitive quotation on a prototype, let us say, a 30-foot boat that has never been built before, using a nebulous set of specifications and no drawing? The poor buyer, trying to pin everything down, inserts a clause which states, in effect, "if we've forgotten anything or made any errors, you, the bidder are responsible."

Conversely, there is plenty wrong with advertised bids. In all fairness, the buyer must detail to the last rivet exactly what he wishes to buy. This advertised bid technique has developed a whole set of manufacturers expert at spotting the loopholes in an invitation.

When price alone is the basis for award, the manufacturer who cuts corners on quality may be the fellow who wins out. As a result, the bargain may not be a bargain or, indeed, may not even be delivered. Many times, it is of prime importance that an item be delivered **on time!** Therefore, the ability and past record of a manufacturer should enter into the decision as to who should get a contract. The prices obtained by bidding are never lower than those obtained by a good negotiator.

And what about the buyer? Our Government buyer receives the finest training in negotiating and intelligent purchasing that money can buy. Yet, his hands are tied. The buyers are faced with the necessity of finding a rule or law that allows them to do something, rather than being able to do anything that does not have a specific law against it. This is a great waste of some high-class and, often, high-paid talent. I say, let them exercise their judgment. Let them weigh not only the price, but the manufacturer involved, his record of quality and on-time delivery, his facilities, his finances and his experience, and make the award on this basis.

Perhaps, however, the most important single objection to advertised bidding is Time. Preparing specs, issuing invitations, evaluating bids, etc., can be a major factor in delaying any program. If we are to keep up with our competition in the Kremlin, we'd better save all the time we can.

—THE END

Edited by:
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Compression & Transfer Molding

The Thermosetting Molder and His Friend, The End-User

As the recession period is ending and the "up-turn" begins, the molder is confronted with the problem of how best to proceed with the renewal of old business and the solicitation of new business. Many custom molders have had to trim down their personnel, including sales. In fact, it seems that the salesman is part engineer; the engineer is part salesman.

With his diminished staff, the molder now is critically analyzing his position with relation to the end-user. He is aware that many of the larger end-users are buying compression and transfer molding equipment or are buying out established molding concerns. He knows, too, that many of the molders are considering the production of their own thermosetting materials. These trends are not necessarily new, but do require serious attention. The molder will have decisions to make. He will have to reconsider his position and determine how best to proceed. Certainly, there must be economy in specialized production. Vertical integration happens usually when there is considerable continuous production of one product. Vertical integration requires mass expansion of both capital goods and personnel.

It is fairly evident that the molder must perform a thoroughly satisfactory service to keep the custom-molding field intact. By specializing in custom molding, he best can serve the end-user by giving him a complete engineering service. He can produce parts more economically and with better quality. His knowledge and experience are there to assist him. A material maker can best produce compounds. The end-user will benefit by obtaining the best prices possible. Actually, the custom molder is in the key position to cooperate with both the material maker and the end-user.

An example of the sort of cooperation desired by end-users can be illustrated very well by relating an experience as told to me by a very successful salesman in the Midwest area. We were sitting together at lunch discussing the ways and means of increasing the use of thermosetting plastics. He had just visited a very large company well-known to most salesmen. His story goes as follows:

After making his proper entries in the reception log, he was directed to the lobby entrance and was told that he would be called soon. While waiting in the lobby, his roving eye detected an inner lobby room which portrayed a provocative sign with words to the effect that salesmen and engineers were invited to look over the products made by this company and the various component parts that went into their products. The general idea was that if a salesman or engineer could find a part that he thought could be improved or could be produced more cheaply, he was invited to discuss the possibility with purchasing and engineering. How intriguing! This company was open to good suggestions. As the hero of this story waited his turn with the buyer, he surveyed a great array of parts. He noted five parts where a thermosetting material of the phenolic type could be used.

It was his turn to be ushered in and somehow he felt that he would be well-received. He was confident that he would not be wasting the buyer's time. After the introductions, he told the buyer that he had selected five of their parts that he would like to have them consider in a thermosetting material, and that they might be worth reviewing. Quickly he stated his reasons for his choices. The buyer listened intently and said, "Would you mind waiting in the lobby again? I will set up two appointments for you to see two development project engineers." This was quite satisfactory.

As he sat waiting, he reviewed what he had said, and decided that he must have used the right ap-

proach. Once more, he walked over to look at the five parts he had discussed, and wrote down certain pertinent points he was going to discuss during his engineering interview. That afternoon was well spent because he came out with two of the five parts for quotation in thermosetting phenolic material, but what happened to the other three?

Since he knew that it was his function to predetermine whether or not a part has a reasonable chance in a phenolic molding material, the three parts had been eliminated by common decision. He knew that it would be expensive for his company to quote a job when there was no chance for success in the first place. During the course of his conversation, he had determined that one of the three rejected parts required thermal conductivity. Another part that was being produced from stamped metal was so low in cost that apparently no phenolic material could compete. The third part required mechanical properties even beyond the strength of phenolic-glass molding compounds. It can be seen readily that this salesman was well-indoctrinated and a valuable asset to his own molding company.

Since the three parts that had been dismissed were of consequential volume and indicated a requirement for impact materials, I decided to contact the salesman's company to discuss the possibility of my visiting with the end-user. The molder gave me permission since he could only gain by my visit.

My visit to the end-user proved fruitful. The thermal conductivity problem was overcome with a high-content mineral inclusion in the compound. The low-cost problem (a pulley) looked like a good bet for the new sisal-phenolic molding compounds. The exceedingly high strength requirement meant the use of continuous phenolic-glass roving. Material maker, molder, and end-user had cooperated.

Of more interest, however, were my conversations with both buyer and engineer. Their remarks on the aptitude and efficiency of the molder's salesman who had visited them are worth recording. The buyer's comments on what is expected of a salesman are:

(1). Appearance of self-control.
(2). A real interest in the product.
(3). Constructive attitude.
(4). Expedite presentation of his company's service.
(5). Ability to listen well.
(6). Briefness, but thoroughness.
(7). Genuineness.
(8). Knowledge of his subject.

This was fine, but what had happened at the engineering level? The engineers indicated that the molder's salesman had performed his function well. This is what they expect of a salesman who assumes an engineering function:

(1). An engineering presentation.
(2). Improvement of their knowledge of plastics.
(3). Ability to comprehend requirements.
(4). Knowledge of testing methods and procedures.
(5). Ability to ask questions intelligently.
(6). Willingness to say, "I don't know."
(7). Have support for his recommendations, as needed.
(8). Reflect the reliability of his company and its confidence in him.
(9). Frankness with regard to doubtful applications.
(10). Assurance that follow-up can be expected.

The above can be said in one word, SERVICE.

—The End

Molded Urethane Foam with Vinyl Skin

Polyurethane padding with vinyl skin conforms to exact contours of delicate instruments contained therein.

A carrying case which will withstand rough treatment, resist liquid and gaseous chemicals, yet cushion delicate instruments contained within has been developed by the chemical division of Bostrom Corp., Milwaukee, Wis. Distributor of one such case is D. E. Stearns Co., Shreveport, La., who used it for its Electronic Holiday Detector, an oil industry pipe tester.

The conventional, tough, outer case is fiber glass-polyester laminate with extruded aluminum rim. The complex contours of the interior are molded of vinyl and Permathane, Bostrom's polyurethane foam, to fit the shape of the test instruments. Bostrom states that the vinyl-Permathane bond is stronger than straight polyether foam.

Permathane foam and vinyl covering were subjected alone and as units to critical laboratory and field testing. Reports indicate that the product is virtually impervious to sunlight, temperature extremes, gases, liquids, and normal compression factors. Foams can be compounded specially and molded to meet an almost limitless number of applications, and the vinyl skin can be made available in a wide variety of surface embossings and colors.

—The End

(Continued from page 1012)

a top panel, provided a cabinet for an arc welder.

The warpage in the front and back panels presented a problem in assembly, even when a shrink fixture was used. The mold for the part in Figure 1 was designed six or seven years ago. A 1° draft angle was allowed for release on the flange. Had the mold been designed with a 96° angle instead of a 91° angle, the piece would have come from the mold at the 90° angle specified on the print; also, the extra 5° angle would have facilitated molding and release. This part was molded from Bigelow mat with a fire-retardant resin. The glass content was approximately 40%.

It was parts such as the one shown on Figure 1, plus many more that had been molded with no thought given to correcting through mold design, that started us on a project to correct any mold being designed at present that could so be justified. However, there are many parts being molded where warpage does not create a problem.

Flanged Dome

Figure 2 shows a flanged dome that could represent a great many molded parts of various contours where a flange is involved. This is a very simple mold that very easily can be corrected to produce a part having a flange at 180°. A flange of this type usually is used to clamp or anchor the piece to some type of assembly, and the flange must be at 180° for sealing purposes.

We would like to point out that many parts of this category are being molded today. Because of warpage of the flange, a shrink fixture is being used to try to bring the flange back to the intended 180°. The shrink fixture, which is never quite as satisfactory as it should be, is more or less a crutch, and a better and cheaper product results when the crutch can be eliminated.

The flanged dome of Figure 2 was made from a preform; the glass content was 40%; and the resin used was unfilled polyester.

Field Chest

The next molds corrected were somewhat more complicated. In this project, we had four matched metal molds involved that were for a multiple-piece chest used by Army Medical Procurement. Each chest included two ends, two sides, one bottom, and one top section. The ends, sides, and bottom had to be cemented together in a fixture. To provide a good bonding surface, it was necessary to hold warpage to a minimum. Figure 3 shows how the cover mold was designed to correct for warpage on this part. All four molds were treated the same, since each had wall thickness and radii that were very close.

The peculiar shape of this part was arrived at after checking parts of a similar nature that had not undergone correction in the mold. In looking at a part rectangular in shape that was quite similar, and was made in a mold having straight sides and ends, it would seem that the total side or end forms an arc toward the center of the piece. In calculating the warpage, however, it was found that most of it took place close

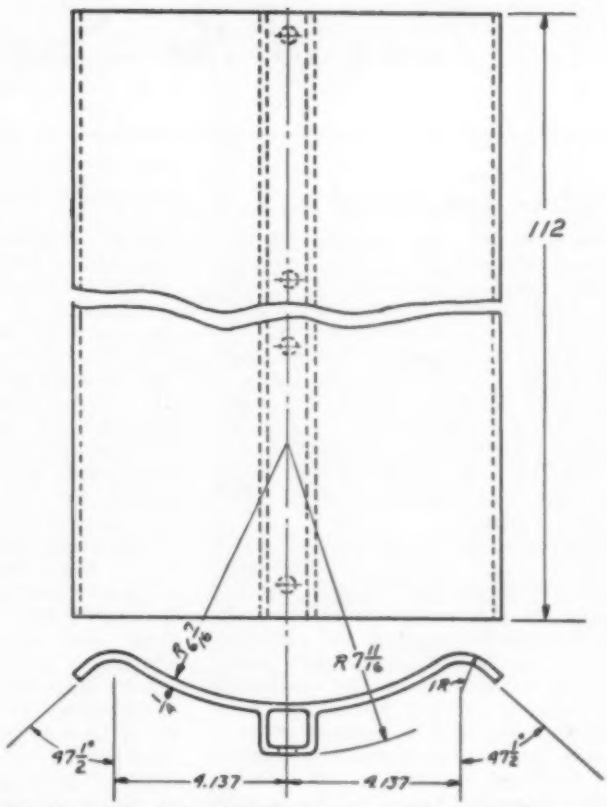


Fig. 4. Quadrant for torpedo launcher, showing mold corrections for warpage.

to the corners, hence the 5° angle for five inches on the sides and ends of the part. If a mold was corrected to the exact reverse of the part from a non-corrected mold, a straight side would not necessarily be the result. The cover in Figure 3 (right) was fabricated with a combination of glass cloth and mat.

Quadrant

The next mold correction project was a quadrant for a torpedo launcher. This part was 120 inches long and the cross-section (which can be seen in Figure 4), would have been subject to warpage unless corrected. A 12-inch male and female Kirksite mold section duplicating the dimensions on the print was made, using the correct glass-resin ratio and the proper cure-time. Several samples were molded to establish the degree of warpage, and no allowance for warpage was made near the center of the part. The hollow section shown in the end view helped to compensate for warpage in the 6 7/16 inch radius. In this case, the correction was made for the flanges at the edges. Allowance also had to be made for the centers of the one-inch radius because as the flanges warped in the centers, the redius had to be moved closer to the center-line, as shown in Figure 4.

Conclusions

With any mold, the designer should consider what is necessary to correct for warpage. It may be less costly to make a small sample mold to establish the degree of warpage than it would be to make an expensive shrink fixture that does only part of the job.

—THE END

News of the Societies

SPE New York Section

Minus its REPPAG, which for convenience sake now meets at the Grumman Aircraft plant in Hicksville, L.I., SPE's New York Section including its VIPAG and Thermoforming Sub-Group met October 15 at the Governor Clinton Hotel, with nearly 150 members and guests in attendance. Following dinner and a plea by Section president George W. Leaf for member-cooperation to expedite the coming ANTEC, the various groups broke with the main body to attend their separate meetings.

Featured at the regular meeting was a discussion on "Lexan Polycarbonate Resins" by Richard J. Thompson, General Electric Co. A thermoplastic polymer suitable for injection molding and extrusion, this resin is the first commercially useful material to incorporate the carbonate radical as an integral part of the main polymer chain. G.E.'s formulation is a reaction product of diphenyl carbonate and bisphenyl A (2,2-bis [4-hydroxyphenyl] propane). Lexan exhibits a high impact strength, excellent dimensional stability, superior heat resistance, and good electrical properties. It can be machined, cold-formed, painted, or metallized.

VIPAG (Vinyl Professional Activities Group) held a panel discussion on "Fillers for PVC Compounds," moderated by Andrew D. Varenelli, Wire & Cable Dep't., General Electric Co. Panelists included: William A. Moore, Philip Carey Mfg. Co.; Larry Jacobson, Diamond Alkali Co.; and Emil Schwartz, Southern Clays, Inc.

Speaking on "Fillers in Vinyl Insulations and Jackets," Mr. Varenelli pointed out that fillers should be free of impurities, have a low oil absorption number, disperse readily, and not agglomerate. In vinyl insulations and jackets, they are used to improve electrical insulation properties and surface appearance, facilitate extrusion, and decrease the marring tendency of the plasticizers. While inexpensive, fillers should not be used indiscriminately since an excess or the wrong type will impair the properties of the end-product.

"Asbestos Fillers" were discussed by William A. Moore who described asbestos as a crystal-form, mineral fiber whose composition is believed to include olefin, iron, magnesium, and silicate. Although available in six basic types, the chrysotile form is recommended for use in vinyl formulations. Several grades can be obtained, as well as several sizes and color values. Asbestos fillers improve cohesive properties during extrusion and calendering, and give less sag when used in plastisols.

Larry Jacobson spoke on "Calcium Carbonate Fillers," describing their effects on the cost and physical properties of PVC compounds. He indicated that calcium carbonates lower compound costs, improve processing characteristics, and help produce better end products.

"Use of Clay in Vinyl Compounds" was described by Emil W. Schwartz who presented data showing the basic values of calcined clays with respect to the electrical stability of vinyl insulation. These clays, mixed with normal kaolins, yield products with uniform tensile properties and improved scuff resistance. In paste formulations, they promote good viscosity control, dry surface fusion, and eliminate sag characteristics.

Addressing the Thermoformers Sub-Group, Joseph Swick, Trono-Matic, Inc., discussed "Heat Cutting of Formed Plastic Sheets." After pointing out that tensile, shear, and compressive strengths enter into any cutting problem, he explained two methods by which heat cutting is accomplished. In one case, the steel rule die is heated by conduction from electrical resistors located in its carrying plate; while in the other, the die is secured to the bed plate and the plastic is heated when the hot plate comes in contact with it. Minimum temperatures should be used so that the knife does not become gummed. In blister packaging, the cutting operation is usually so fast that heat will not distort the blister.

SPI New England Conference

Nearly 400 members and guests of SPI's New England Section gathered October 9-10 at Wentworth By-The-Sea, Portsmouth, N. H., to partake in discussions scheduled for the group's 14th annual conference. In addition to surveys of the industry overseas, internal analyses, and a technical paper, the program included golf and fishing events for the men, as well as sight-seeing tours and other recreational activities for the ladies.

The opening session, presided over by John J. Adamitis, Beacon Plastics Corp., featured a welcoming address by C. Russell Mahaney, SPI-president, followed by a panel discussion on the plastics industry in the U. S. S. R. Moderated by William T. Cruse, the panel included C. W. Blount, Bakelite Corp., C. Russell Mahaney, St. Regis Paper Co., and Dr. A. G. H. Dietz, M. I. T.

Otto Morningstar, The Morningstar Corp., presided over the business session held on the morning of the 10th. Papers subsequently presented included: "Traffic and Transportation Costs," Robert J. Heanue, Tupper Corp., and Herman Matthei, New England Motor Rate Bureau, Inc.; "New Materials—A Survey Paper," J. H. DuBois, Consultant; "The Money Situation," William H. Raye, Jr., The First National Bank of Boston; and "Present Status of Business in Molder's Plants in New England," Horace Gooch, Worcester Molded Plastics Co.

SPE Kentuckiana Section

Kentuckiana Section, Society of Plastics Engineers, Inc., held its first Fall meeting September 24, at the Mason-Dixon Room, Louisville, Ky., with 21 members and guests in attendance. Following dinner, a short business meeting was held while the committee chairmen and officers made their reports.

It was pointed out by Section president Jack Berutich that the recent formation of SPE's Tri-State Section resulted in the loss of about one-third of Kentuckiana's membership, and that an extra effort must be made to enlist new members. Vacancies on the executive staff, created by this loss, were filled by Daryl Hicks, who becomes vice president; Bill Watkins, who moves into the treasurer's position; and Randy Carhart, who occupies one of the chairs.

Speaker for the evening was Stanley Prosen, Naval Ordnance Laboratory, who discussed the design and development of a plastics cartridge case. He illustrated his talk with slides and a short movie film.

ASME Announces New Officers

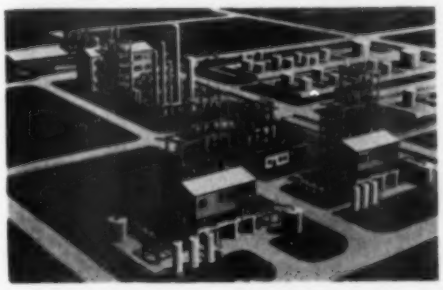
Following official tabulation of ASME's membership ballots, secretary O. B. Schier confirmed election of the entire, unopposed slate which had been announced at the Society's semi-annual meeting, held last June in Detroit, Mich. The electees will be installed at the forthcoming annual meeting to be held in New York City, December 1-5.

Newly elected officers include: president, Glenn B. Warren, General Electric Co.; vice presidents, Charles H. Coogan, Jr., University of Connecticut; Gordon R. Hahn, Gibbs and Hill; John W. Little, Goslin-Birmingham Mfg. Co.; Thomas J. Dolan, University of Illinois; Harold Grasse, Black and Veatch; and directors, Arthur M. Perrin, National Conveyors Co.; and Richard G. Folsom, Rensselaer Polytechnic Institute.

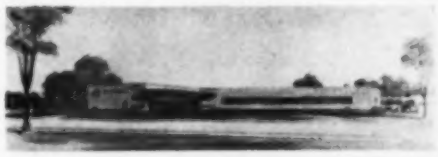
New York Pigment Club

The New York Pigment Club has scheduled the following two speakers for its December 11 and January 8 meetings: Louis J. Venuto, Columbian Carbon Co., "Special Factors Influencing Carbon Black Dispersions"; and R. L. Whitney and R. P. Bates, National Lead Co., "New Developments in Corrosion Inhibitive Pigments." Dinner reservations can be made through R. Copland, L & R Organic Products, 50 White St., N.Y.C.

News of the Industry



Architect's conception of Air Reduction's new lab.



Design layout of Air Reduction's PVA plant.

Air Reduction Expansions

Construction of a new laboratory and office building at Piscataway Township, N. J., is currently underway according to latest reports from Air Reduction Chemical Co. Also scheduled is an extensive pilot plant facility, to be erected at the same site. Together the projects are expected to cost over $1-million.

Auxiliaries to the company's existing pilot plant development laboratories at nearby Bound Brook, Middlesex Borough, N. J., they will provide facilities for increased technical service and applications work in the field of acetylene-derived chemicals. Major products involved include vinyl acetate monomer, acetylenic alcohols and glycols, and vinyl stearate. The new pilot plant facility will be devoted exclusively to the production and sale of polyvinyl alcohol.

Biggest expansion expenditure, however, will be the $12-million allocated to the polyvinyl alcohol resin plant which is being built at Calvert City, Ky. Upon completion, the plant will turn out 20-million pounds of resin annually. The project includes an expansion doubling the capacity of the 45-million pound vinyl acetate monomer plant, since this material is the basis of polyvinyl alcohol resin production. This plant should be on stream by early 1960.

The manufacturing process to be used by Airco was obtained under license from the Kurashiki Rayon Co., Ltd., of Osaka, Japan. There, the major use for the resin is in the production of a synthetic fiber known as vinylon. Air Reduction has also been granted U. S. rights to the vinylon fiber process, and is optimistic about its prospects in this country. Primary market in the beginning, however, should be film.

Plastics Merger Within Ciba

The plastics division of Ciba Co., Inc. has merged with its manufacturing affiliate, Ciba Products Corp. From now on, Ciba Products Corp. will be the headquarters for all Ciba management, sales, and technical service personnel working with Araldite epoxy resins. The company will continue to operate in Kimberton, Pa., until new research and production facilities are completed in Toms River, N. J., and its administrative and sales offices are transferred to new quarters in Fair Lawn, N. J.

Reason for the merger and expansion, according to company spokesmen, is the rapidly expanding market for epoxy resins. World sales for 1957 were 40-million pounds, and estimates for 1968 are in excess of 170-million pounds. The new plant in Toms River will have an initial capacity of 18-million pounds annually. The board of directors for the new corporation will consist of: Robert Kaeppeli, chairman; H. B. Marshall, president; D. B. Dyche, treasurer; T. F. D. Haines; C. E. Hutz; and D. M. Joseph.

Vinyl Emulsion Primers Gain

An interesting, but little known fact—the repaint market comprises 68% of residential structures. With the increased consumer use of vinyl exterior paints (usually PVA emulsions), there is an increased demand for vinyl emulsion-penetrating primers. National Starch Products, Inc., has developed a series of pigmented primers which bind the chalky surface, penetrate to the substrate, and dry to a hard film. Brushes and other equipment are cleaned with water only. These primers take the place of expensive and time consuming sand blasting, wire brushing, and sealing with solvent-based primers.

RCI Schedules Resin Plant

A 20-acre site on the Greens Bayou Waterway near Houston, Tex., has been chosen by Reichhold Chemicals, Inc., for the erection of a new resin plant. Scheduled for completion by mid-1959, at a cost of $1-million, the unit will produce the full RCI line, including alkyds, polyesters, and emulsions. Don Leever, currently the firm's director of technical service at Kansas City, will direct the operation.

The new plant is designed to fill a gap in the geographical network formed by RCI's 14 plants throughout the country. Located a convenient distance from the firm's waterfront storage tanks in Mobile, Tex., it should afford customers in the area faster delivery than heretofore obtainable.

Du Pont To Enter Film Field

It seems fairly certain that E. I. du Pont de Nemours & Co. will enter the polyethylene film field. Investigations are underway, and the film department is building a laboratory and pilot plant adjacent to the polychemicals department's main polyethylene resin facility—the Sabine River Works, Orange, Tex. Construction is scheduled for the immediate future, and the facilities should be in operation by the latter part of 1959.

A film department technical section will be set up for the evaluation of resins, development of film manufacturing techniques, and production of film for market development. The program will not alter the role of Du Pont's polychemicals department as a supplier of polyethylene resin to the film industry.

Opens Lexan Semi-Works Plant

Completion and startup of a semi-works plant for the production of Lexan polycarbonate resin has been announced by General Electric's chemical materials department. Located in Pittsfield, Mass., the facility is designed to produce increased quantities of the material for market development work, and will provide prototype information for commercial plant design. It should also aid process development and product technology.

Pilot plant quantities have been available to molders for some time. Parts molded from Lexan have been evaluated in more than 100 different applications, including items for electrical communications, the electronic industry, aircraft parts, automotive items, appliances, and gages.

More on Celanese-ICI Venture

As mentioned in this column last month, Celanese Corp. of America and Imperial Chemical Industries, Ltd., have formed a company for the production of Teron polyester fiber. The company's name has been changed from Lindum Fibers Corp. to Fiber Industries, Inc., and a 215-acre site near Shelby, N. C., has been chosen for the erection of a plant.

Executive offices of Fiber Industries, Inc., will be located in Charlotte, N. C., sharing space with Celanese's textile division. Construction work on the main plant will begin the first of next year, and production will begin by stages. Eventual capacity of 40-million pounds annually is expected.

Enters Mold Design Field

In a new-type innovation, a precision molder is offering an injection mold design service to other molders. The firm is G-W Plastic Engineers, Inc., of Bethel, Vt., whose president, O. A. Westgaard, is a recognized leader in die design and injection molding. G-W's staff will detail the die right down to the individual shop prints which go direct to the mold maker.

The company handles high-precision items with intricate shapes, internal corings, and threads—factors which forced it into the mold design field.

Goodrich Opens Carbopol Unit

A $3-million, 70,000 lb./month plant for producing Carbopol has been opened by B. F. Goodrich at Calvert City, Ky. A thickening, suspending, dispersing, and emulsifying agent, Carbopol has gone through five years of intensive research and market development studies. The material is a fluffy, white powder, a vinyl polymer more specifically known as carboxypolymethylene.

Unlike many other thixotropic agents, Carbopol is highly ionic and slightly acidic. It can be neutralized by almost any base to form a thick gel. This action can be effected not only with an aqueous solution, but with alcohols, glycerines, glycols, and

Golf balls suspended in water through the use of Carbopol. A non-practical application, but it shows its suspending potential.

even solvents which are not soluble in water. Foremost applications for the material are in the cosmetic and textile printing fields. It imparts the proper thickness to inks for screen printing, and imparts good flow characteristics to both pastes and liquids contained in squeeze bottles. It may even eliminate the "shake well before using" label on immiscible pharmaceuticals.

High priced when compared with carboxymethylcelluloses, Carbopol is actually cheaper because of the small amounts used—less than 1%. Non-toxic, it is affected only slightly by temperature and aging. Uses are practically unlimited.

New Pipe Extrusion Technique

Development of a new extrusion technique and die design makes it possible to manufacture polyethylene pipe in large diameters from Allied Chemical's A-C Polyethylene Pipe Compound. The field was formerly restricted to metal ceramic and fiber piping. Actual diameters are practically unlimited.

A-C Polyethylene's high melt viscosity made it impossible to extrude by ordinary methods. At present, Carlon Products Corp. and Orangeburg Mfg. Co. are using the technique to extrude the pipe on standard machinery; however, interested extruders should contact Allied's Semet-Solvay division for further information.

The material's molecular structure, which consists of chains averaging about 70,000 carbon atoms in length (as opposed to low-density polyethylene chains of 2,000 carbon atoms), give it a life expectancy of 50 years at pressure ratings several times higher than those possible with conventional polyethylene. In addition, no cracking, slitting, or pin holing was reported. In a typical test, pipe was cycled 90,000 times to three times normal pressure for one second out of every ten. No deterioration was shown.

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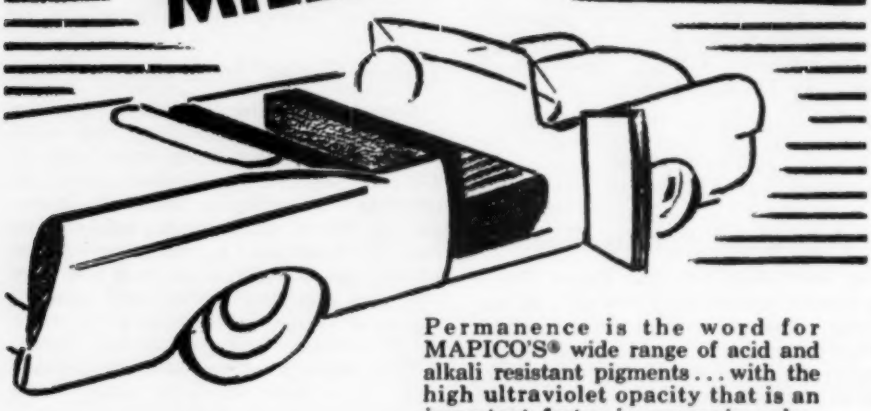

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Polyethylene Goes Underground

A $1½-million polyethylene film producing plant, with two of its three stories buried below ground, has been opened by Chippewa Plastics, Inc., Chippewa Falls, Wis. The film will be used for garment bags and a host of other packaging applications. The company recently became the first to produce heavy-duty, 10-mil bags for the packaging of fertilizer, seed corn, and chemicals.

The unique 42,000 square-foot plant incorporates the most modern methods of materials handling and production. Polyethylene granules are unloaded from railroad tank cars by an air-conveyor system into 50,000-pound capacity storage silos on the ground floor; the car's 100,000-pound load being handled in about 10 hours. This raw material drops by gravity from the silos into 600-pound capacity hopper trucks on the floor below. These are wheeled over loading chutes for conveyance to a battery of extruders located on the lowermost level.

Extruded film is directed upwards to finishing machines on the ground floor, adjacent to the packing and shipping areas. The new facilities give Chippewa a capacity of more than 1-million pounds of film per month. In order to supply raw materials in quantity, the company will maintain its own fleet of railroad cars equipped for air conveying. Founded just 10 years ago, Chippewa's sales have expanded from $6,264 in 1949 to $3,741,107 for the year ending June 30, 1958. The firm now employs 137 workers.

Chippewa's three-story polyethylene film plant. Two of the stories are underground.

The new building is of contemporary curtain-wall design with aluminum framing and large glass-wall sections. Heating is by electricity. General offices will be located in the new plant; the old being used to expand research and development facilities. A smaller production plant and warehouses will be maintained at several locations around Chippewa Falls.

Farrel Buys Extruder Builder

Farrel-Birmingham Co., Inc., Ansonia, Conn., has purchased a West Coast manufacturer of small extruders—Electrophysical Engineering Co., division of National Automotive Fibers, Inc. The Orange, Calif. firm offers a line of EPE extruders which range in screw diameters from 2-6 inches. All feature "Inductomatic" heating. Inventor of the Inductomatic element, R. H. Wenzel, will join F-B's extruder division in Ansonia.

Sales and service of the EPE line will continue under Leonard Rose. Manufacturing will be carried on in Orange, and in F-B's plant in Rochester, N. Y. Reviewing Farrel-Birmingham's setup—the firm produces heavy-duty extruders with screw diameters ranging up to 24 inches. There are two plants in Connecticut; a gear-manufacturing plant in Buffalo, N. Y.; the Rochester machinery plant; and sales-service offices in key cities throughout the United States.

Reichhold Schedules Plant

A phthalic anhydride plant, capable of producing 30-million pounds annually, is being constructed in Elizabeth, N. J., by Reichhold Chemicals, Inc. Scheduled for completion by Fall of 1959, the plant will be one of the largest of its kind in the world. The building is located on the same site as other RCI facilities, and is designed for quick expansion to a capacity of 50-million pounds.

Plant design combines the modern engineering features of Badger Mfg. Co., general contractors and procurement engineers, with the technical experience of Reichhold. The facility will employ the fluid bed catalyst technique of manufacture, enabling the firm to conform to the most rigid of industrial specifications. RCI has been producing phthalic anhydride since 1939.

Announce Bakelite Name Change

Effective November 15, Bakelite Co. becomes Union Carbide Plastics Co. The change marks another step in Union Carbide Corp.'s program to correlate corporate identity with products. The plastics company will continue to produce and market its line under the familiar trademark "Bakelite," however.

Coincident with the name change are the promotions within the sales organization. J. L. Rodgers becomes director of sales, and T. W. Sharp has been named director of product marketing. In addition, planning and specialized marketing functions such as new product and process development, market development, advertising, and promotion have been separated from selling and technical service activities.

Atlantic Purchases Macromol

Atlantic Chemical Corp., Passaic, N. J., has purchased controlling interest in Macromol Corp., Matawan, N. J. The latter firm is a basic producer of macro-molecular chemicals and polystyrene resins under the Klein process. It also constructs under

ELECTRICAL GRADE

RC Plasticizer DIDP

A specially prepared Di-iso-decyl Phthalate, with superior electrical properties, for use in vinyl insulation compounds!

★ High volume resistivity
★ Low volatility
★ Retention of physicals on aging
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For optimum price-performance balance in a primary plasticizer, check with Electrical Grade RC PLASTICIZER DIDP!

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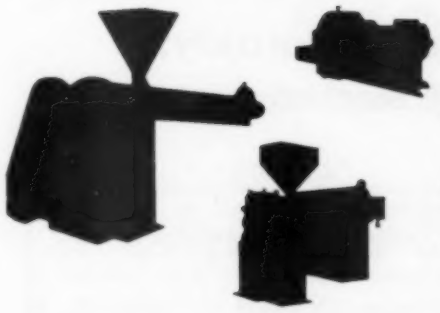

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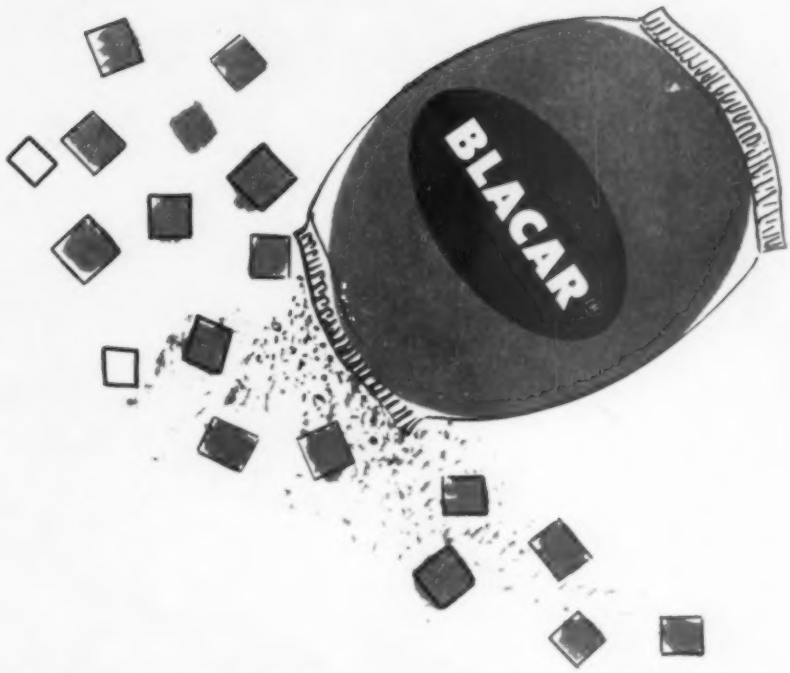

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PVC Resins and Compounds

PVC RESIN—Blacar #250—UL-approved for complete interchangeability in recognized compounds. High Molecular weight—low gel count—excellent dry blending and extrusion characteristics. Intermediate and low molecular weight resins also available.

PVC COMPOUNDS—In natural, white or black—dry blend or diced.

Blacar #2800—UL-approved for type T and TW wire—oil at 60°C —80°C appliance wire.

Blacar #2700—UL-approved, primary insulation, for type T, TW, TF, TFF wire—oil at 60°C—wide range of low-tension applications.

Blacar #2600—UL-approved for type E, TF, and TFF wire and cable insulation.

Specialists in wire covering—Cary can modify existing formulations or custom-formulate to the most exacting requirements. Technical assistance, data, or working samples on request.

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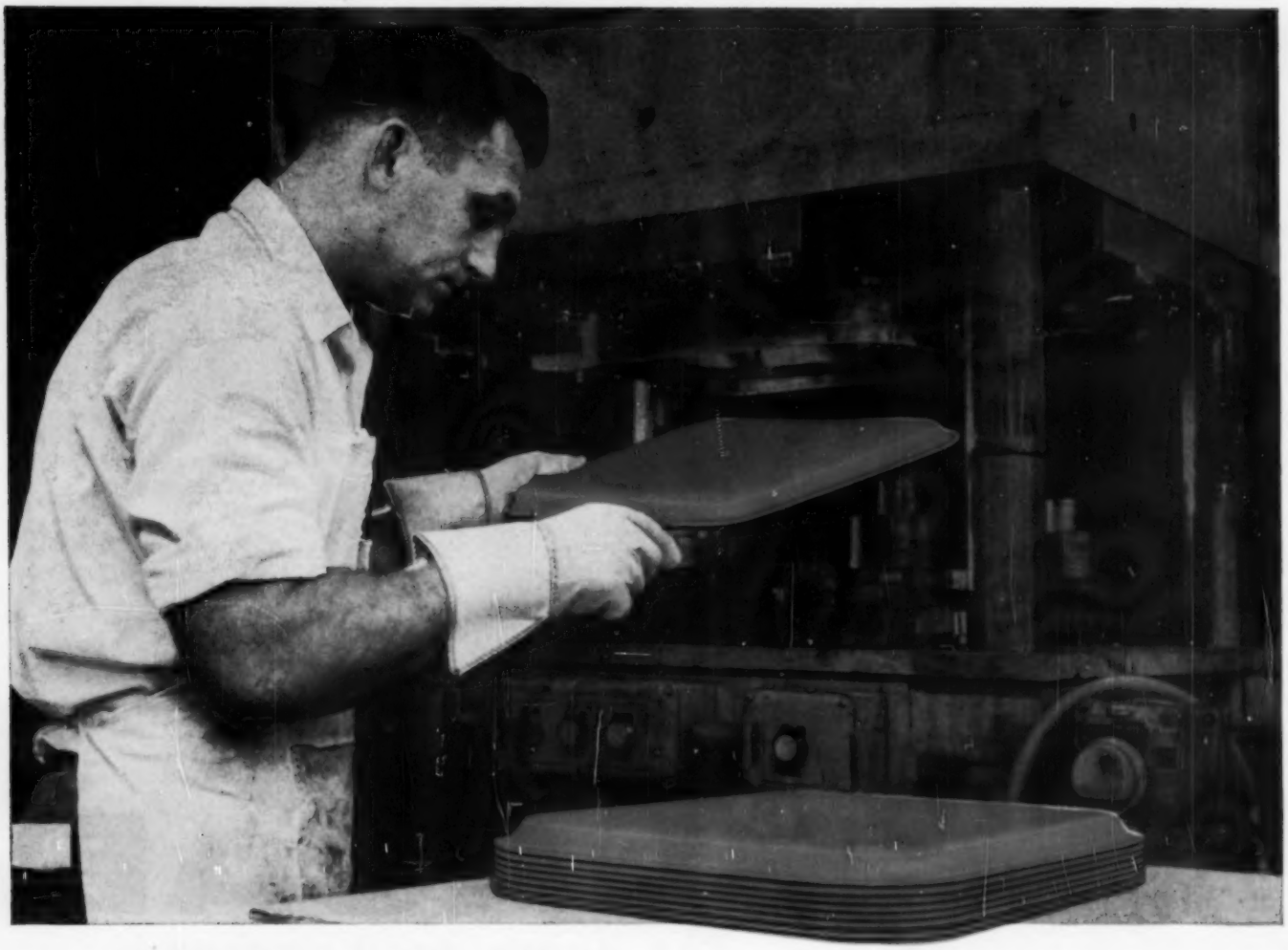

For high-speed molding of reinforced plastics . . .

GLIDPOL 1012 polyester resin cures quickly, provides excellent "hot strength" and surface gloss!

GLIDPOL 1012 is recommended for molding and laminating—where good "hot strength", surface gloss and fast production rates are desirable. This rigid type polyester resin is capable of curing in short molding cycles, and is especially suited to the manufacture of a wide variety of reinforced plastic products.

Use all-purpose GLIDPOL 1012 for producing storage and mixing tanks, all types of containers, hoppers, tote boxes, trays and many other products. Glass fibers in conjunction with GLIDPOL 1012, produce a tough structural material that possesses excellent chemical resistance.

Write for details on how GLIDPOL 1012 can help you produce plastic products faster, better, more economically. Also available: GLIDPOL polyester resins for other fabricating techniques plus a complete range of fadeproof GEL-KOTE coatings that impart smoothness, durability, color appeal, to any reinforced plastic surface.

LIQUID RESIN PROPERTIES	
Viscosity @ 77° F.	800-1000 cps.
Polyester resin content	68%
Weight per gallon	9.5 lbs.
CURING RECOMMENDATIONS	
Catalysis	0.75 to 1.5% Benzoyl peroxide
Curing	1-2 min. @ 230°-250° F.
Pot life @ 77° F. 1% Benzoyl peroxide	10 days

QUALITY Glidden PRODUCTS

GLIDPOL POLYESTER RESINS

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license polystyrene-producing units both here and abroad. Max Klein will continue as president.

Atlantic produces dyestuffs, pigments, and organic intermediates at facilities in Nutley, N. J., and anthraquinone vat dyes at a wholly-owned subsidiary, Peerless Color Co. of Plainfield, N. J.

Escambia Opens Research Lab

October 17 marked the formal opening of Escambia Chemical Corp.'s new research laboratory in Wilton, Conn. Located on a 45-acre site, the two-story brick and steel structure affords some 50,000 square feet of research space. About 50 persons are employed at present, and this number should double ultimately. Organized in 1954 by Electric Bond & Share Co. and United Gas Corp., Escambia initially produced PVC, methanol, ammonia, and nitrogen products. The Wilton facility should enable the firm to expand its basic research, as well as develop new products in the above-mentioned fields.

Dedicates Research Center

W. R. Grace & Co., who entered the chemical industry only six years ago, has opened a $5-million chemical research

Grace Washington Research Center

center at Clarksville, Md. Located just 25 miles north of the nation's capital, this facility will serve as the focal point for research and development activities carried on by the firm's entire chemical group.

Enclosing more than 96,000 square feet of floor space, two-thirds of which are devoted to laboratory and experimental equipment, the new center brings under one roof 250 scientists and technicians who formerly had worked in three different states. In addition to organic, inorganic, and polymer chemistry, work at the center will be directed toward catalyst and agricultural research, as well as new product development. A research services department will be responsible for maintenance and manning of all specialized instruments being used by the various departments.

Since its inception in 1952, Grace's chemical group has expanded to include 40 plants within the jurisdictional structure of seven operating divisions. Starting with an ammonia plant in Memphis, Tenn., Grace first acquired Thurston Chemical Co., and in 1954 merged with Davison Chemical and Dewey and Almy Chemical, both of which were old and respected firms. Naco Fertilizer Co., established by Grace in 1907, and Thurston were merged in the present Davison Chemical Division. Dewey and Almy was tri-parted to form the chemical, overseas, and Cryovac divisions, while subsequent expansions brought about Grace Chemical, Polymer Chemicals, and the Grace Research and Development divisions.

The 104 year old parent firm was founded in Callao, Peru, by W. R. Grace who entered business as a ships chandler. Following acquisition of shipping interests, he emigrated to New York and in 1880 became the first naturalized citizen to be elected mayor of that city. Further developments involved the company in various South American industrial and plantation enterprises, the progress of which culminated in 1952 with the formation of the chemical group. Manned by more than 8,000 employees in Europe and the Americas, this new-born phase of Grace's activities accounts for 38% of the parent firm's total sales volume. Emphasizing research and development as the key to future progress, the company in 1955 spent $4.8 million in that work, and plans to double this figure in 1959.

In Brief . . .

Foster Grant Co., Inc. has opened sales offices in Chicago and Detroit. Thomas Egan has been named to head the Chicago office, which is located at 4900 W. Madison St.; Frank Giordano heads the Detroit office, located at 2970 W. Grand Blvd.

(*Continued on page 1064*)

ANOTHER NEW IMPCO

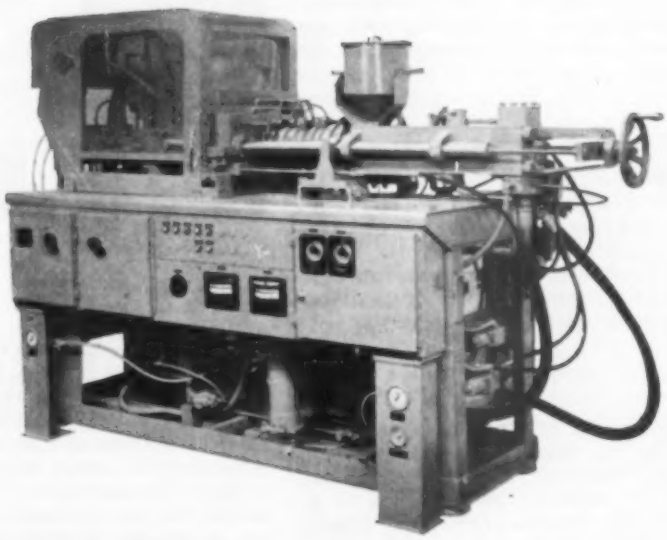
Special Purpose Injection Molding Machine for Containerlike Molding

MODEL

CA30-75

- 30-50 gram capacity
- 30 molding cycles per minute*
- shut-off nozzle for pre-pressurized molding
- simplified mold construction
- built-in die and platen cooling arrangement
- separate injection and clamp hydraulic circuits
- shock mounted control panel
- photo electric recycling monitor
- 75 ton clamp
- 9¼" stroke
- fully automatic

*dependent on material and mold construction



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Names in the News

Allen E. Polson

Allen E. Polson has been appointed to the newly-created post of director of sales for Thompson Chemical Co., Pawtucket, R. I., manufacturer of Truflex plasticizers and Trulon vinyl resins. Mr. Polson has been associated with Du Pont in various capacities, and for the past five years served as manager of the plastics department in Goodyear's chemical division.

Fred H. Reynolds has been appointed director of market development for Narmco Resins & Coatings Co. Mr. Reynolds has over 15 years experience in industrial and commercial selling, and most recently was in charge of market development for the Bellwood Co.

Malcolm B. VerNooy has been named product manager, new chemicals group, for Union Carbide Chemicals Co. Dr. VerNooy will direct the market development of Carbide chemicals for use in resin applications, and will be responsible for the marketing of acrylates.

William H. Schloenbach has been appointed a sales representative for B. F. Goodrich Chemical Co., and will make his headquarters in Schenectady, N. Y. He joined the firm in 1950, and most recently served as a product engineer in the Hycar nitrile rubber sales department.

The transfer of three technical representatives has been announced by Union Carbide Chemicals Co.: **Paul A. Hiznay** to the Philadelphia district, **Francis R. Kean** to the Newark district, and **Charles D. Schmidt** to the Detroit district.

Charles J. McCarthy has been appointed product sales manager in charge of automotive original equipment, for General Tire & Rubber Co.'s Bolta Products division. This covers Boltaflex automotive upholstery, as well as Boltaron moldable sheeting for dashboard and headliners. He previously served as sales manager of the custom molding division.

Antoine Khawam has been appointed technical director of Englander Co.'s development program and its laboratory in Baltimore, Md. Dr. Khawam will have full charge of all the firm's research and development activities.

Alfeo J. Martina has been appointed an applications engineer for Formica Corp., a subsidiary of American Cyanamid Co. A registered architect, Mr. Martina has been the active head of A. J. Martina & Associates, Cincinnati, O.

Urs Brennwald has been elected executive vice president of Fjellman American, Inc., Joliet, Ill., manufacturer of hydraulic hot-plate presses for producing plastic laminations. He will direct the firm's sales, and will supervise technical and installation problems.

Jack R. Moore

D. F. Behney

D. F. Behney has been elected executive vice president of Harwick Standard Chemical Co. He has been a vice president and a director since 1956. **William L. Lasser,** purchasing agent and assistant warehouse superintendent, moves up to vice president in charge of operations. The board also elected **Harvey G. Greer,** technical director, to the new position of vice president in charge of technical developments. **Jack R. Moore,** president of Harwick, has been elected president of Harwick's manufacturing affiliate, Republic Dye & Chemical Co. **Frank A. Sancic** has been made executive vice president of Republic, and Curtis J. Harwick, Jr., becomes vice president in charge of development.

John R. Cunningham

Kenneth M. Hayes

Kenneth M. Hayes has been appointed manager of manufacturing activities for the vulcanized fiber department of Taylor Fibre Co., Norristown, Pa. He formerly served as manager of sales promotion and training. **John R. Cunningham,** former over-all department manager, assumes responsibility for managing technical and quality-control operations. **Alvin W. Platt** has been named a sales engineer, and is assigned to the San Francisco office.

William J. McCaig, former Polyfoam sales manager, has been named general sales manager for all products manufactured at General Tire & Rubber Co.'s Marion, Ind., plant.

Karl H. Rohde, Jr., has been appointed an organic chemicals sales representative for the Dewey & Almy division of W. R. Grace & Co., in the Southern California area. He previously served as sales and advertising manager of Precision Metal Products, Inc.

Arthur E. Bayce and **Marvin A. Deisz** have joined the staff of Shell Development Co.: the former as a chemist in the polymer and chemical applications department; the latter as a metallurgist in the materials enginering and corrosion department.

Mayhew M. Clark has joined the plastics division of Visking Co. as a technical sales representative in the agricultural field. He will concentrate on the marketing of black Visqueen film for such farm applications as mulching, silage covers, and grain storage.

Norman L. Hardwicke has been named group leader of the high-pressure polyethylene research group at Monsanto Chemical's plastics division plant in Texas City, Tex.

John D. Shoemaker has joined the engineering department of Monsanto Chemical Co.'s plastics division, Texas City, Tex.

News from Abroad

Exhibitions in Germany

A variety of interesting developments in the plastics field were noted at recent exhibitions in Germany. Among the exhibits at the Hannover Trade Fair (held on April 27 to May 6, 1958) that caught the eye by novelty of design or use were: new German machines designed for making permanent flat pleats in plastic film or attractive combinations of gathers and ruching; a French high-capacity three-roll mill for plastics, in which the rolls are arranged in a staggered series and the sides are completely enclosed in large, protective, one-piece casings of fiber-glass laminate; small manual welders for making bags from plastics sheets, particularly cellophane and polyethylene; a German non-woven fabric consisting of viscose fibers bonded together by a special patented method that uses no adhesive of any kind, and for which are claimed the advantages of being chemically pure, having high porosity and absorption capacity, so that it is particularly suitable for use in impregnation and coating processes; and a variety of combinations of Moltoprene foamed plastic with felt, textiles, artificial leather, paper, plush, etc., some of which are self-adherent and can be adhered to wood, glass, metal, textile, rubber, etc., also combinations of vulcanized horse hair and Moltoprene for upholstery.

What was particularly noted at the Hannover Fair was the increasing interest in plastics by firms unconnected with the plastics industry. Only a few years ago, one or two steel and iron companies began to make plastic pipe (PVC and polyethylene). Displays at the Hanover Fair reveal that several additional metal-manufacturing companies have now taken up plastics, mainly glass-reinforced resins.

Phoenix-Rheinrohr A. G., Vereinigte Hütten u. Rohrwerke showed a 7,000-liter container for hydrochloric acid, a conveyor belt, ventilating pipe, 1,700-liter container for a mixer, and shipping cases, all employing glass-reinforced resins. A. G. fur Zink Industrie vorm. Wilhelm Grillo, featured materials for roofing, store fronts and balconies in the form of reinforced plastic sheet, plain or corrugated, transparent or opaque, pigmented or not. Textilmaschinenfabrik Johannes Menschner displayed parts for machinery, also a complete electro-switch cabinet.

Achema Exhibition

At the 12th Achema Exhibition held at Frankfurt on May 31 to June 8, 1958, Farbwerke Hoechst showed Asplit P hot molding resins, and Asplit G casting resins. These are combinations of phenolics and furfural having high resistance to heat, chemicals, and solvents. Maximum service temperature for Asplit P is 180° C. and 150° C. for Asplit G. Thermal conductivity of these materials is higher than for porcelain, PVC, hard rubber or glass, but substantially lower than that of impregnated electro-graphite. The casting resin is intended for small series of intricately-shaped parts for which the production of molds is uneconomical, and for large complicated components. Concrete pipe 15 centimeters in diameter and up, that are centrifugally treated with an Asplit cement has proved useful for conveying acids and solvents in factories. Pipe 80 centimeters in diameter is being made experimentally.

The interesting improvements in whirl sintering developed by Knapsack Griesheim A. G. drew a good deal of attention. This firm is credited with being the first to demonstrate at this show that whirl-sintering can be applied successfully to PVC, so that greatly increased use of the method is looked for since PVC is cheaper than polyethylene. Another of the firm's new developments is the whirl-sintering of Cellit B by which surfaces are obtainable with gloss, scratch resistance, and thermal resistance that are superior to those of other plastics. Improved whirl sintering also now gives a glossy surface to Hostalen. The company also showed a sinter-spray device with blower that is designed to coat metal with plastics either by flame-spraying or sintering.

German firms are now making progress in the use of PTFE. At the Achema were seen a variety of packings and jointings of this material; laminates of PTFE sheet and asbestos cloth, very flexible and strong in comparison with fiber-glass laminates; complete apparatus covered with PTFE, including a small autoclave and various kinds of bellows.

Chemieprodukte G.m.b.H. showed their Polyveriet, a material specially produced for chemical apparatus and consisting of a modified synthetic resin and alkali-free glass fibers. This material resists temperatures to 300° C., corrosion and weathering, and is used in making armatures, pipe, valves, and other components for chemical industry equipment. Kera is another special material for the chemical industry. Produced by Gewerkschaft Keramchemie, it is a compound of fillers and phenol-formaldehyde resins, worked without pressure, and cured in autoclaves with high-tension hot air. It has dimensional stability up to 145° C. and excellent resistance to changes in temperature. It also withstands acids (except oxidizing acids), alkalis, and solvents. Keranol O and Keranol E are varieties of Kera that resist chlorine and hypochlorite, nitric, (to 30%), and dilute chromic acids.

Japanese Plastics Developments

The world-wide economic let-down this year is reported to have caught Japan with excess stocks of PVC materials, and new uses must be found for them locally. Accordingly, government and private organizations have been experimenting with PVC film in highway construction, with what are said to be satisfactory test results. The chief draw-back, for some uses at any rate, is that of cost of the material.

PVC sheet has been tried as cover material to protect freshly-poured concrete pavements; as diaphragms, instead of Kraft paper, between concrete pavement and road-beds to prevent friction; and as joint filler for concrete pavements. Rigid PVC tubing has been used to cover iron pipe cores serving to reinforce concrete, thereby eliminating expansion of metal pipe as a cause of cracks in the concrete surfaces.

At the same time, research on PVC types is being carried out and Kureha Kasei Co. has reportedly succeeded in producing a super heat-resistant PVC by a low temperature polymerization method developed in collaboration with Dr. Sakurada, of Kyoto University. The PVC, which resists temperatures up to 130° C., is to be manufactured at first on a pilot-plant scale at the rate of three to four tons a month.

The mechanical properties of plastics materials can be improved with the aid of photo-elasticity investigations, K. Miki, of the Hyogo Industrial Promotion Laboratory, has revealed. Mr. Miki has been studying the photo-elasticity of high polymers, and announced that he has succeeded in improving the properties of polyester resin-reinforced materials and polyvinyl chloride/plasticizer blends by means of photo-elasticity data.

Toyo Koatsu Co. is to use its own technique and engineering staff to produce acrylonitrile. It is planning to build a plant having a monthly capacity of 1,500 tons, the local press reports. Natural gas, to be supplied by an affiliate, will be the base material for the necessary cyanic acid, and later on also will serve for the acetylene. For the time being, however, acetylene will be produced from carbide.

Hoechst Polypropylene Research

Research on the production of polypropylene along new lines is being conducted by the Laboratory for Solvents and Plastics of Farbwerke Hoechst A.G., Frankfurt/Main. In his report on some of the results obtained so far, Dr. G. Bier proposes a theory of the mechanism of the polymerization of crystalline polypropylene that he claims indicates for the first time that the $TiCl_3$ of the catalytic system $TiCl_3+Al(C_2H_5)_3$ plays a definite part in the chemical reactions responsible for chain growth. The mechanism, has not been proved, but seems to agree qualitatively with numerous experiments, and R. Bier invites discussion.

He further reveals that work at Hoechst led to the development of catalyst systems which differ from the Natta system and are exceptionally well suited to olefine polymerization. However, no details are disclosed as to the nature of the systems.

New Materials

Write item numbers on Readers' Service Card to obtain more information.

High-Impact PVC Resins

Two rigid PVC compounds, identified as QGD-5020 and QGD-5010, have been developed for pipe and contour extrusion applications by Bakelite Co. Competitively priced and available in commercial quantities, both compounds are free-flowing and, with a slight modification of existing equipment, can be processed at rates as high as 100% greater than other rigid PVCs.

Both materials have been listed by the National Sanitation Foundation as suitable for making potable-water piping. The tougher compound, QGD-5020, is recommended for high-impact applications and currently is being used by the U.S. Navy as part of a decontamination system for ships caught in radioactive fall-out. This material exhibits good weatherability and chemical resistance, and can be re-worked with a minimum degradation of impact properties. QGD-5010 is inert to many strong acids, alkalis, metallic and ammonium salts, alcohols, and aliphatic hydrocarbons. It is expected to find use in petroleum and slurry lines where corrosion and deposit build-up are common problems. Typical properties of these materials include:

	QGD-5010	QGD-5020
Specific gravity	1.30	1.34
Heat distortion, °C.	69	67-69
Izod impact, ft.-lb./in. notch	0.6	15-20
Hardness, Rockwell R.	110	107
Tensile strength, psi.	8,500	6,500
Elongation, %	50	30
Flexural strength, psi.	11,800	10,000
Flexural modulus, psi.	450,000	372,000
Chemical resistance, 30-day immersion test:		
Change in flexural strength, %		
In H_2SO_4	+9.94	+6.7
In HCl	−42.7	−65.4
Change in weight, %		
In H_2SO_4	+0.8	−0.083
In HCl	+7.41	+23.2

Readers' Service Item 180

Ultimate flexural strength, psi.	76,500
Tangent proportional limit	47,000
Initial modulus of elasticity, psi.	3.8×10^6
Ultimate tensile strength, psi.	54,400
Compressive strength, psi.	56,500
Water absorption, % weight change	0.11
Hardness, Rockwell M	119
Barcol hardness	74
Specific gravity	1.938
Resin content, %	36.6

Readers' Service Item 181

Phthalocyanine Pigment

A red-shade phthalocyanine pigment, exhibiting good color stability at elevated temperatures, is being marketed under the name Cyan Blue XR-55-3770 by American Cyanamid Co.'s pigments division. This pigment can be compounded with polystyrene and, when exposed to the high temperatures associated with this type processing, not only retains its original hue, but increases slightly in strength.

Cyan Blue XR-55-3770 has excellent crystal stability, and probably will find application in other thermoplastic resins, in the thermosets, and in organosols. It does not bleed in solvents, and has excellent light fastness, and acid and alkali stability. Properties include:

Specific gravity	1.52
Weight, lbs./gal.	12.7
Bulking value, gal./lb.	0.0787
Specific resistivity, ohm-cm.	15,000

Readers' Service Item 182

Low Cost Wood Filler

A super-refined White Pine wood flour, identified as Code 1010 and recommended as a low-cost replacement for alpha cellulose, is being marketed by Wilner Wood Products Co. The flour is free from bark, dark specks, dirt, tramp metal, and other foreign material and may be used as a filler in urea-formaldehyde compounds, melamine compounds, as well as many others. It is packaged in 100-pound returnable, burlap bags, 45-pound, non-returnable, multi-wall paper sacks, or can be shipped bulk-loaded in trailers or cars. Typical properties include:

Specific gravity, approx.	0.34
Acidity, pH	4.38
Titratible acidity, 0.1N NaOH, ml.	2.1
Extractibles:	
Diethyl ether, dry wgt., %	5.0-5.2
Acetone, dry wgt., %	7.5-9.5
Moisture, max., %	4.0
Ash content, %	0.2
Bulk density, lb./cu. ft	12-15

Readers' Service Item 184

Polyester-Glass Fabric

Known as Stanpreg PI, an all-purpose polyester resin pre-impregnated glass fabric combining high elevated temperature strengths with flame resistance, has been placed on the market by Standard Insulation Co. Laminates prepared from this material are rated as self-extinguishing, and have retained up to 50% of their original property-values at operating temperatures as high as 400° F., for periods as long as 200 hours.

Available in roll form, Stanpreg PI is supplied with various fabric constructions and resin contents, as well as certification for use under MIL-R-7575A. A summary of physical properties under normal conditions includes:

Epoxy-Polyester Detergent

A solvent-based, clean-up detergent for the removal of uncured epoxy, polyester, and similar resins has been introduced by Isochem Resins Corp. Called Isoterge 1405, the material is said to meet the demands for a non-flammable cleaning material of minimum toxicity. It dissolves waste resins, converting them into water suspensions. High flash point makes Isoterge 1405 a super-safe cleaner for equipment, tools, table tops, and containers—even in hazardous plant areas.

Since very small amounts are required to disperse substantial resin accumulations, the material is reported to be most economical. All resins are soluble in the material with the exception of polyethylene. Properties are reported as follows:

Color	Light straw
Odor	Slight
Specific gravity	1.02
Viscosity @ 25° C., cps.	30-40
Flash point, open cup, °F.	190
Minimum ignition temperature, open air, °C.	290
Weight, lbs./gal.	8.5

Directions for use are: clean off excess resin with scraper, saturate cloth with Isoterge, wipe away resin, soak cloth in water, wipe surface, rinse, and allow to dry. For stubborn clean-up jobs, the surface to be cleaned should be scrubbed with a brush (not nylon bristle).

Readers' Service Item 183

Foam Splicing Adhesive

Incorporating a synthetic polymer which imparts unusual spread characteristics, a foam splicing adhesive called Bondmaster R275 has been placed on the market by Rubber & Asbestos Corp. This adhesive lends itself to substantially thinner glue lines than are possible with conventional formulations, thus giving greater yield-per-gallon, maximum softness of bond, faster grabbing, and avoiding of dimpling. All this is accomplished without sacrifice of bond strength.

Bondmaster R275 can be used with almost all types of urethane foams, natural

latex foams, and sponge, bonding each to itself or to the others to form seams which are stronger than the materials themselves. It has a synthetic elastomer base, consists of 14-16% solids, and is shipped at a viscosity varying from 600-1,000 cps. A clear, pale, yellow liquid, this adhesive dries tack-free.

Readers' Service Item 185

Epoxy Resins & Intermediates

With the introduction of Epoxide 201, Union Carbide Chemicals Co. enters the epoxy resin field—previously, the firm was concerned only with resin and chemical intermediates. Due to its method of preparation, the material fits in better with that UCC division's line, rather than Bakelite, which normally markets Union Carbide Corp.'s resins.

Union Carbide Chemicals found that cyclohexene oxide-type diepoxides homopolymerized readily in the presence of catalytic amounts of strong acids to give hard, thermoset resins. Polycarboxylic acid in near-stoichiometric proportions reacted very rapidly (at 50-120° C.) with these homopolymers to give cross-linked resins with a wide variety of properties. Basic hardeners such as polyamines were somewhat less reactive and required high-temperature cures. The same situation is true for polyhydric phenol hardeners.

Epoxide 201 is a clear liquid having a low viscosity of 650 cps. at room temperature. This is an important factor in the filling of voids and avoidance of bubbles.

Molecular weight	280.35
Boiling point, °C.	215
Pour point, °F.	30
Solubility in water, % by wt.	0.3
Viscosity, cps.	1,810
Flash point, open cup, °F.	310

A cycloaliphatic, Epoxide 201 is free from the color-unstable phenolic groups present in bisphenol A-based epoxies. Low initial color and resistance to discoloration by ultraviolet light, heat, and air oxidation broaden 201's usefulness in epoxy plastics and coatings. A higher heat distortion point of 450° F., as opposed to 264° F. for a diglycidyl ether of bisphenol A—using a phthalic anhydride hardener in both instances. By proper selection of the hardener system, 201 can be cured in a few minutes at room temperature to hours at elevated temperatures. It cures slowly with amines, thus giving a long pot life, and cures rapidly with the anhydrides and dibasic acids.

A wide variety of polycarboxylic acids may be used as hardeners, including those formed by the reaction of dibasic acids and polyols. The more acidic the hardener, the shorter the cure time. This is also true with the anhydride hardeners. Boron trifluoride complexes promote fast cures, even at room temperatures.

Two other epoxy materials have been introduced by Union Carbide Chemicals: vinylcyclohexene dioxide (1-epoxyethyl-3,4-epoxycyclohexane) and dicyclopentadiene dioxide (an endo-isomer). The former is a very fluid compound which can be used as an epoxy diluent with no sacrifice in heat distortion temperature. The epoxycyclohexane group is reactive under acidic conditions, whereas the epoxyethyl group is reactive under basic conditions. It can be polymerized alone to a three-dimensional resin; it can be used to form condensation resins with dicarboxylic acids; and can be used as a monomer for the preparation of polyglycols containing unreacted epoxy groups.

Molecular weight	140.18
Boiling point, °C.	227
Freezing point, °C.	—55
Solubility in water, % by wt.	18.3
Viscosity, cps.	77.7

Dicyclopentadiene dioxide is used as a chemical intermediate for resins, plasticizers, and protective coatings. Combined with amine hardeners and polyol initiators, the material gives resins with heat distortion temperatures in the 300° C. range.

Molecular weight	164.21
Appearance	White Powder
Melting point, °C.	184

Readers' Service Item 186

VANSTAY®

Vinyl heat and light stabilizers

Our trade mark of 12 years standing came into being with VANSTAY L, the first nontoxic light stabilizer for Vinyls.

Today, the VANSTAY line includes a number of materials developed to keep pace with Industry's demands for higher temperature Vinyl protection in process and in service.

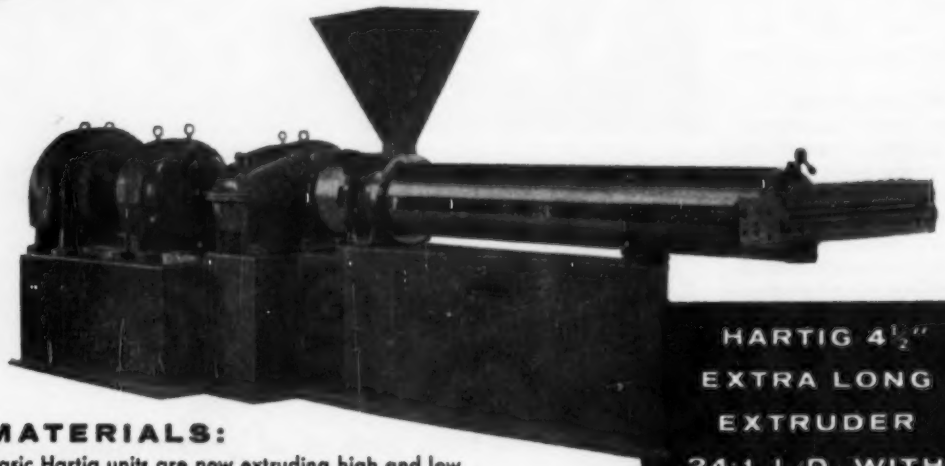
Expanded research and technical service can be of immediate assistance in solving your Vinyl stabilization problems.

R. T. Vanderbilt Co., Inc.

230 PARK AVENUE · NEW YORK 17, N. Y.

PACKAGED

HARTIG EXTRUSION



HARTIG 4½" EXTRA LONG EXTRUDER 24:1 L/D, WITH SHEETING DIE

MATERIALS:

Basic Hartig units are now extruding high and low density materials most used in packaging—Polyethylene, Polypropylene, Vinyls, Styrenes, and many others.

PROCESSES:

Film Extrusion—Blown Tubing, Unsupported Film, Extrusion-Coating, Extrusion-Laminating
Sheet Extrusion—Vacuum Forming
Blown Containers—Molding
Compounding—Reprocessing.

FEATURES:

Unexceeded capacity—available in four L/D ratios; unvented or vented for continuous removal of moisture, solvents and monomers; with constant pitch, decreasing depth or variable pitch screws, self venting, recirculating, and many alternate constructions to match the specific requirements. Instrumented for close control of quality and automatic operation.

AUXILIARY EQUIPMENT:

Auxiliary equipment includes film or laminating dies, dies for blown tubing and lay flat tubing and special purpose dies. Also payoffs, takeoffs, and troughs; cooling and polishing rolls; laminators with unwind and rewind stations; pelletizers and other special purpose equipment. Matched with Waldron and Ross equipment for complete packaged units.

Send for Your Copy

of the new booklet describing the complete line of Hartig Extruders and Auxiliary Equipment.

Established 1890

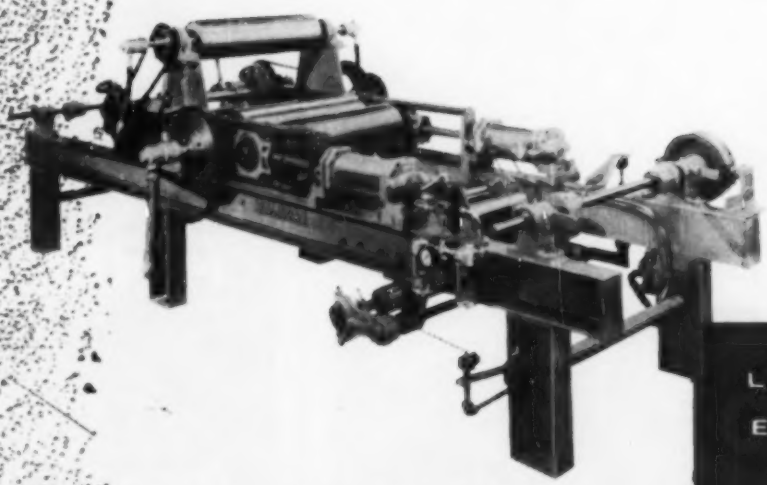
HARTIG EXTRUDERS

Division of Midland-Ross Corporation
Mountainside, New Jersey

UNITS

WALDRON

LAMINATION

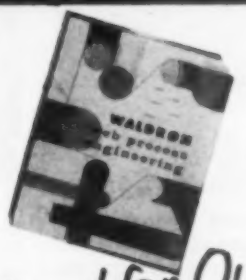


LAMINATORS
•
EMBOSSERS
•
PRINTERS
•
COATERS

WALDRON LAMINATORS

In the field of extrusion-lamination, Waldron Engineers have developed to a high degree of success the equipment required to take advantage of the physical properties of thermoplastic resins to produce a laminate of pre-formed metered film which is applied to a supporting web while still sufficiently fluid to obtain good adhesion.

In the design and construction of complete processing lines, Waldron works closely with the Hartig and Midland-Ross Divisions of Midland-Ross Corporation. This offers an unequaled combination of engineering skills and experience.



Send for Our New Catalog

No. 10

with its 130 pages of descriptions, photographs and drawings indicative of the broad line of Waldron Web-Processing Equipment.

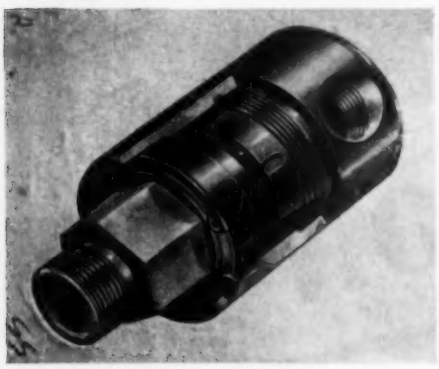
John **WALDRON** *Corp.*

Subsidiary of Midland-Ross Corporation

NEW BRUNSWICK, NEW JERSEY

New Equipment

Write item numbers on Readers' Service Card to obtain more information.



Roms rotating union.

Rotating Pipe Unions

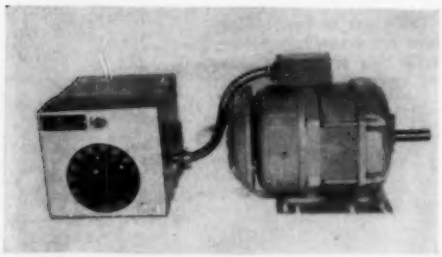
Rotating pipe unions, that have been rendered corrosion-proof by the use of ceramic-coated seats, are being marketed by Roms, Inc. Adaptable for water-cooling use with all types of rotating equipment, these units reportedly give up to nine times the wear-life of conventional unions.

The Roms unions incorporate brass housings, stainless steel rotors and springs, sealed bearings and precision-lapped seals to give maintenance-free, minimum friction performance. Both single- and double-flow types are available, and parts are interchangeable on standard thread sizes. Various sizes include: ½-, ¾-, and 1-inch pipe threads, and 1-14 machine thread.

Readers' Service Item 187

Semi-Conductor Motor Control

An electric motor speed control, incorporating a silicon semi-conductor rectifier to transform alternating to direct current, is being marketed in an MRS series by Carpco Mfg., Inc. Since these systems do not use resistors, there is no power loss in the form of heat. Voltage is varied before rectification to provide a smooth, instantaneous control and constant torque over the entire speed range.



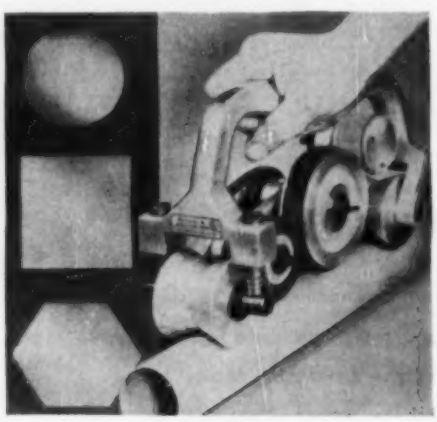
Carpco semi-conductor variable motor control, shown attached to motor.

A single control unit can handle one or more motors, up to its own rated capacity. They may be purchased separately with instructions for wiring, and may be used with shunt, compound, or series wound motors, according to the load conditions. These controls are available in two models, MRS 61 and MRS 102. Both required 50/60 cycle, single phase power sources; the former with 115 volts, and the latter 230. Horsepower ratings range from ¼-1.

Readers' Service Item 188

Portable Pipe Marker

A self-contained unit for single line printing of inspection marks and trade names on the surface of pipe, tubing, bars, or flat stock, has been introduced by Jas. H. Matthews & Co. Known as Model No. 230, this printer is furnished with solid printing dies or type holders with interchangeable type.



Matthews bar and tube printer.

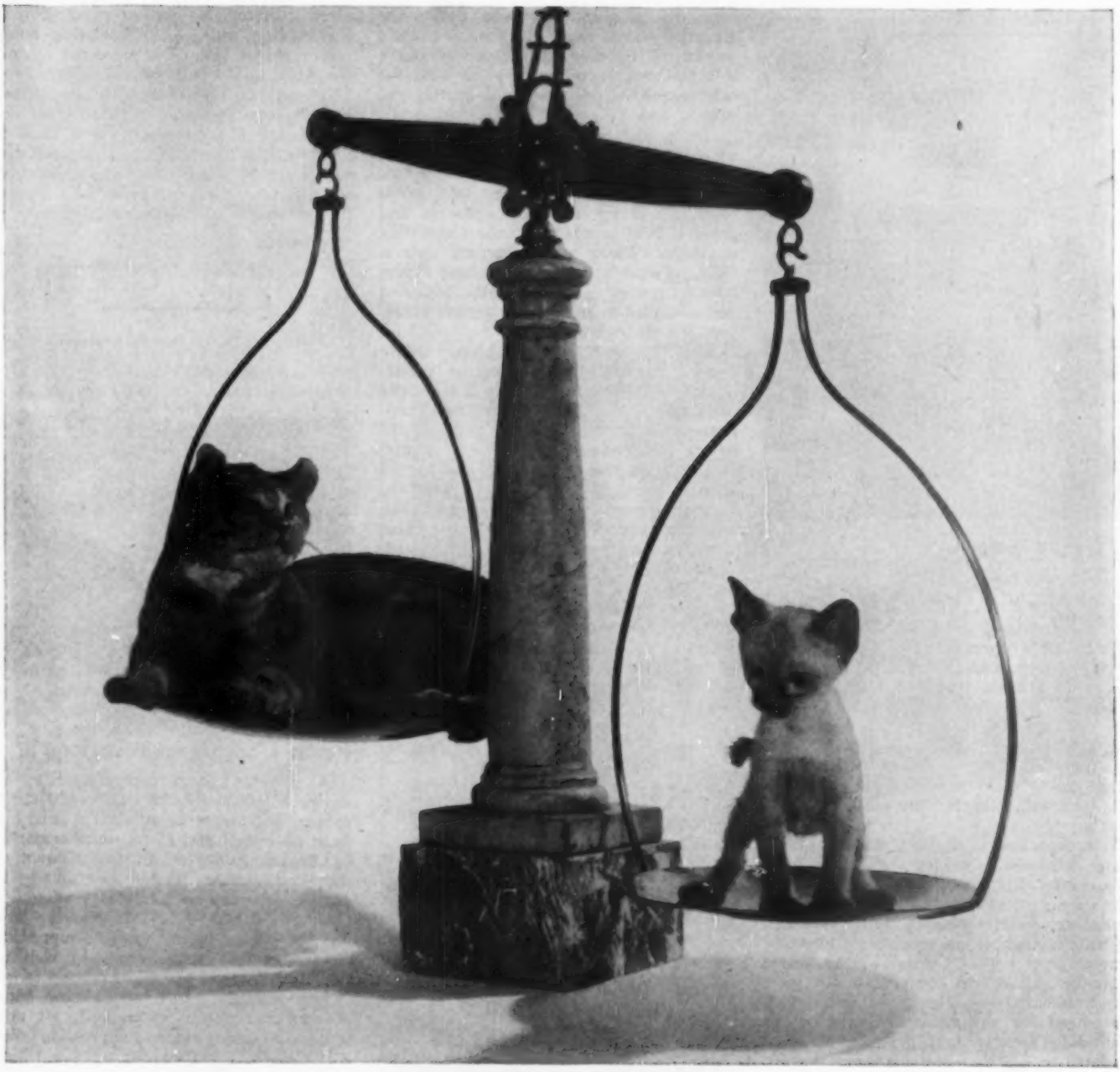
Framework and V-rolls are constructed of magnesium, and the entire unit weighs only 6½ pounds. The printing roll is actuated by a rubber-covered drive roll as the printer is rolled along the stock. Alternate printing on various contours requires little, if any adjustment. Overall length is 12 inches; width, 5 inches; and a maximum 12-inch mark can be made in one turn of the printing wheel.

Readers' Service Item 189

ARGUS

announces

MARK LL



LESS GIVES YOU MORE

NEW MARK LL powerful vinyl stabilizer – latest addition to the Argus line – gives you more and better stabilization at *less* cost. Easily dispersible liquid Mark LL stabilizer will give you:

MORE heat stability;
MORE light stability;
BETTER maintenance of the true tones of sensitive organic pigments.

For complete information on Mark LL – or any Argus vinyl stabilizer or plasticizer – write for technical bulletins and samples.

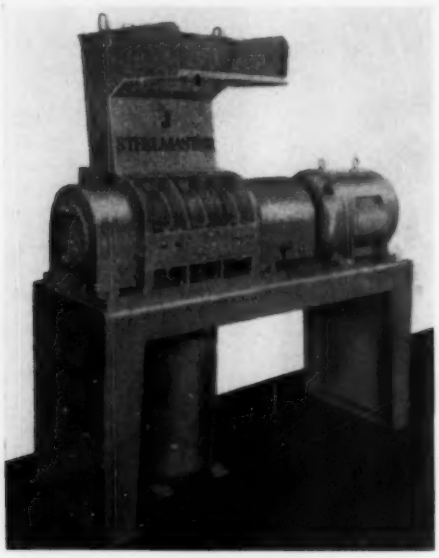
Whatever your vinyl processing problem, Argus has the answer – in line products or in its research laboratory.

See us at National Plastics Exposition, Booth #544

ARGUS CHEMICAL CORPORATION / New York and Cleveland

Main Office: 633 Court Street, Brooklyn 31, N. Y. Branch: Frederick Building, Cleveland 15, Ohio

Rep's.: H. M. Royal, Inc., 4814 Loma Vista Ave., Los Angeles; Philipp Bros. Chemicals, Inc., 10 High St., Boston; H. L. Blachford, Ltd., 977 Aqueduct St., Montreal.



B & J's Steelmaster granulator.

Heavy Duty Granulator

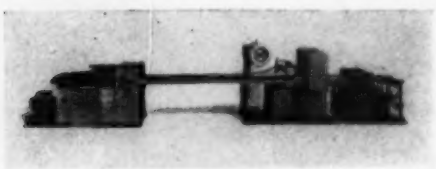
A high speed granulator, designed for heavy duty operations involving bleeder scrap, lumps, and extrusions of all tough-to-grind plastics, has been announced by Ball & Jewell, Inc. Equipped with a specially designed hopper, this unit can handle lengthy extrusions without pre-cutting, and in operation has reduced PVC pipe up to eight inches in diameter with ⅝-inch wall thickness into useable particle sizes.

Incorporated in the Steelmaster's design are: extra-heavy, welded steel plate; rotor machined from a one-piece alloy steel forging; dual mounted flywheels; and self-aligning, double spherical roller bearings. Cutting chamber is reinforced to withstand great impact loads, and the knives can be adjusted to compensate for wear and re-sharpening. The granulator can be arranged for pneumatic discharge or for grinding directly into drums and other containers. Other characteristics of this machine include: motor hp., 40-50; throat size, 9 by 24 inches; and over-all dimensions in inches, length 88, width, 37, and height, 93.

Readers' Service Item 190

Automatic Bubble Packager

A bubble packaging machine performing automatic feeding, forming, loading, printing, sealing, and die-cutting operations has been introduced by Erdco Engineering Corp. This machine accurately indexes all operations, and incorporates a radio-frequency sealing press to weld the bubble and its cover without heating the product.



Erdco bubble packager.

An automatic, brake-type, de-reeling unit automatically delivers plastic as required. The sheeting is kept wrinkle-free by the conveyor which grips and holds its edges during the entire process and automatically releases after the die cutting operation. Width of the feeding web is fully adjustable up to 21 inches. Paperboard covering is mechanically de-curled and de-reeled to supply the amount necessary for the operation.

After the bubbles have been vacuum formed, the sheet continues across a loading station where the product is manually or automatically loaded. Product identification is printed on the package just before the sealing operation, and a steel rule die cuts the packages to any desired shape.

Operating with a 12-cavity mold, this unit can produce up to 60,000 packages per day. A master panel controls the complete sequence, and individual controls are located at each station. A 220-volt, 60-cycle, three-phase power source is required for operation. Access panels have electrical interlocks, and all components are protected by overload current breakers. An electrical resistance heat sealing unit can be incorporated if required.

Readeds' Servire Item 191

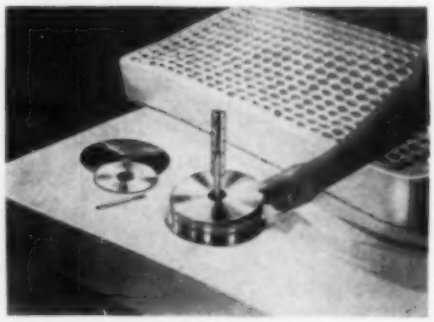
IMS oil cooler.

Injection Machine Oil Cooler

A cooler for hydraulic fluids which will handle temperatures commonly found in injection molding machines up to 16-ounce capacity, has been placed on the market by Injection Molders Supply Co. This unit uses air rather than water as the cooling medium, and incorporates its own circulating pump for transfer of the fluid through the cycle.

A reversible fan, powered by a ⅛-hp. electric motor, is used to pass air over the cooling coils. The circulating pump motor draws ¼-hp., is protected against overload, and wired for connection to a 220 volt, 60 cycle, single-phase power source. Both the inlet and outlet are designed for ¾-inch piping, and each is fitted with a thermometer. If desired, the cooler can be connected to the mold cooling system where it will bring the temperature to within 10° of ambient.

Readers' Service Item 192



Wohler Foam Tester.

Foam Compression Tester

A portable, foam compression tester, designed especially for use with cored rubber, polyurethane, or vinyl foams, has been developed and placed on the market by Browning Instrument Co. Known as the Wohler Foam Tester, this unit gives precise compression modulus readings in standard R.M.A.-A.S.T.M. figures, and can be used to measure compression change at low temperatures as well as modulus drift and hysteresis properties.

This tester is sturdy, and has no complicated mechanisms to maintain. It utilizes a 50-square inch compression foot and specially designed disc weights which extend its compression range to 62.5 pounds. The unit has a thickness range from two to six inches, and no calculations are necessary since cushion height and deflection are indicated automatically on separate, easy-to-read scales. It is designed to operate through a tiny incision in the top slab of the cushion. Complete set includes compression foot, scales 10 weights ranging ½-10 pounds, scalpel for making incision, instruction sheet, and felt-lined leatherette carrying case.

Readers' Service Item 193

High Speed Plastics Welder

A high speed, hand-operated welder, incorporating a Calrod-type electrical heating element, has been placed on the

Kamlar high speed hand welder.

market by Laramy Products Co. Designated Model 10-HS, this unit utilizes compressed gas which is passed through the handle and barrel of the welder where it is heated to the desired temperature.

The complete kit consists of an air pressure regulator, gage, electric cord, welder, spanner wrench, heating element requiring 110 volts a.c., two welding tips, and a shoe which controls the rod feed. All metal parts are of stainless steel. Welding rod is fed through the tip permitting one-hand operation, while the other is free to turn circular work or feed additional rod to the unit. The tip is arranged to cut the rod off neatly at the end of a seam. Speeds up to 50 inches per minute can be achieved and the welder will accommodate rod diameters of 1/8-, 5/32-, and 3/16-inch.

Readers' Service Item 194

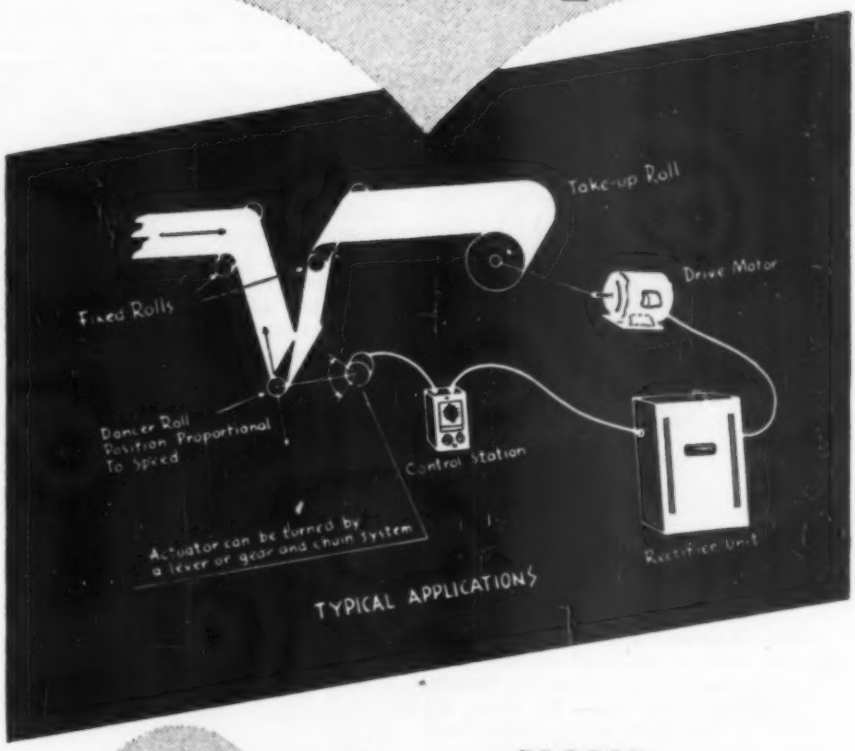
Improves Extruder Series

An improved extruder series, engineered to deliver higher production capacities in each of five bore sizes, is being marketed by Davis-Standard, division of Franklin Research Corp. Available in 2½, 3½, 4½, 6, and 8-inch sizes, D-S Thermatic units incorporate a one-piece cylinder with an Xaloy liner. The head clamp and hinge arrangement permits the head to be opened and closed by adjusting a single bolt.

The smaller models are equipped with heavy-duty helical gearing, while the larger units feature the herringbone type to permit greater horsepower ratings and higher stock screw speeds. The gear set is spray lubricated, while bearing surfaces are fed by a force-feed system. The drive-end of the stock screw is equipped with four keyways, and is tapered for easy disengagement from the drive gear. Labyrinth oil seals are used throughout, and a combination of fins, heating elements, blower, and damper give precise temperature control.

Readers' Service Item 195

Servospeed
Automatic
Take-Up



Here's HOW IT WORKS ...for Textile and Plastics Processing

A small tension change positions the actuator shaft so as to call for motor speed change to restore preset tension. Thus a constant linear feet per minute windup may be achieved even though the radius of takeup roll increases with each turn to otherwise increase linear speed versus radius build-up. Speed is now made proportional to position of dancer roll and tension is held essentially constant, as is the linear rate of material travel.

These and other models of electronic motor speed control systems available from 1/50th to 2 horsepower.

WRITE

Servospeed
DIV of ELECTRO DEVICES, Inc.
4 Godwin Ave Paterson, N. J.

Plastics Applications

Write item numbers on Readers' Service Card to obtain more information.

Rack of Trimbrite metalized Mylar tapes.

Do-It-Yourself Metalized Mylar

A line of tarnish- and fade-proof Mylar polyester tapes in metalized chrome, gold, and copper has ben introduced by Marglo, Inc. Laminated to vinyl, the tapes are embossed in four patterns and backed with pressure-sensitive adhesive. Trade-name for the tape is Trimbrite.

Trimbrite comes in individual rolls ¾-inch by 10 feet, packaged and displayed in an open metal-wire rack 13½ by 14 by five inches. This rack holds 36 units. Contents of each roll is visible.

Readers' Service Item 196

Tubing For Pharmaceuticals

Using Kel-F, Minnesota Mining and Mfg. Co.'s brand of halofluorocarbon plastics, and a new fabricating technique, Sanford Plastics Co. has produced a thin-walled tubing for pharmaceutical packaging. Tradenamed Sanstress, this tubing has a wall thickness of five mils, representing a three-mil reduction over thicknesses previously necessary to withstand sterilization temperatures.

From left to right in the illustration are: packaged aspirin tablets, a one-shot disposable syringe, and a piece of the tubing. Each of the items pictured had been steam-sterilized for 25 minutes at 260° F., with little or no fiber distortion. The product is impermeable to alcohol and formaldehyde, heat seals to form a strong bond, has a tensile strength of 4,500-5,700 psi., and an impact strength of 3.6 pounds.

Readers' Service Item 197

Zipees nylon roller skates.

Molded Nylon Roller Skates

Lightweight, nylon roller skates for children in the 6-11 age group are available from Manning Mfg. Co. Called Zipees, the skates are sold with a guarantee to replace any broken parts. Wheels and body are molded of Du Pont's Zytel nylon resin, and are adjustable to lengths of 7½-10¼ inches.

Weighing but 1½ pounds per pair, Zipees can be worn indoors and out, with any type of footwear. Clamps are not needed—wide safety straps hold the skates firmly to the foot, even when the child is wearing sneakers or ballet slippers. Ankle straps are cushioned with urethane foam. Double roller ball bearings afford speed, and a neoprene pad under the skate mounts permits greater "give" and maneuverability

The combination of aluminum with plastic parts makes rusting unlikely, and oiling is not required. The use of nylon enabled the manufacturer to reduce the number of parts needed from over 100 to about 17. The skates were engineered by Charles Jones & Associates, Inc., working in conjunction with Du Pont engineers. Skates are available in combinations of black and white, red and white, blue and white, and black and red. Color is molded-in, and will not chip, peel, fade, or discolor.

Readers' Service Item 198

Cut-away view shows both cable and Resinite vinyl jacketing.

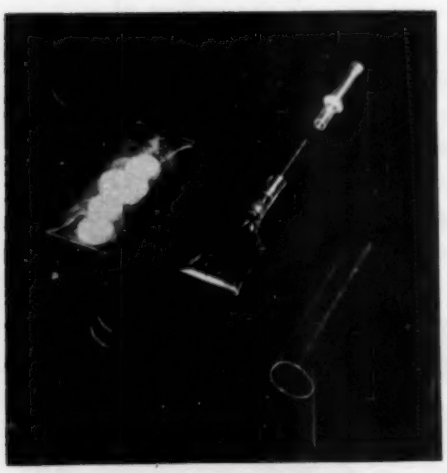
Extruded PVC Jacketing

An extruded tubing for jacketing coaxial, umbilical, and other cables is available from Borden Chemical Co. Known as Resinite EP-145, the PVC material is said to exceed nearly every specification required for MIL-R-6855, Class II, Grade 60 synthetic rubber.

Compared with neoprene, the product is reported to have 11-31 times the abrasion resistance at various test cycles, and is considerably lighter. Lower specific gravity, higher tensile strength, and greater abrasion resistance permit thinner walls and material economies. Flame resistant and self-extinguishing, Resinite EP-145 remains flexible at temperatures below —100° F.

Cable manufacturers apply it as a jacket using standard pneumatic or chemical dilatant procedures. It is available in red and black, with inside diameters ranging from ¼-1½ inches. Standard coil lengths are 150, 200, and 400 feet.

Readers' Service Item 199



Sanstress tubing and products.

Charles C. Eckert, manager of Celanese Corp.'s Belvidere, N. J., plant inspects a sheet of triacetate film as it enters a dryer.

Photographic Base Film

Independent emulsion coaters can avail themselves of a triacetate base material for photographic film that is being produced by Celanese Corp. of America at its Belvidere, N. J., plant. This product exhibits optical clarity, uniformity, and dimensional stability under changing temperature and humidity conditions.

In production, viscous triacetate dope flows through a slit onto a highly polished revolving surface where it is cast into rolls 45 inches wide and up to several thousand feet in length. Initially, it is being manufactured in two gages: 0.0035-inch and 0.0054-inch.

Readers' Service Item 200

Glass-Polyester Sleeper Cab

A custom-tailored sleeper cab fabricated

Reinforced plastic sleeper cab.

Taylor-Emmett Timer insures

REPEATABILITY OF CYCLES

Type D765 ROBOTRON* Timer—the complete timing control for plastic molding presses. Panel is so simple that any possible cycle sequence can be set up in as short a time as 10 seconds, without particular skill or familiarity.

CHECK THESE FEATURES:
Completely Packaged Unit • Airtight Enclosure • Rapid Setup • Cycles Quickly Changed • Extended Rangeability • Enclosed Electrical Component • Plug-in Elements • Etched Circuits

Taylor-Emmett **NEV-R-GRIND*** *Valves mean* **NO WARPING...NO FOULING**

Three-Way (E380) and Two-Way (E370) Valves are fully balanced, cylinder operated, compact and have excellent capacity. Available in 3500 and 6000 psi. body ratings. Both are normally operated at 35 to 50 psi. air pressure.
Fully balanced design permits application of pressure to any port connection. Type E370 is available either normally open, or normally closed. Sizes 1" to 4".

Type D532 Cylinder-Operated Valve is half the size of conventional valves, has one quarter the parts. Extremely compact and maintenance-free. 750 psi. Sizes ½" to 2½". Normally open: normally closed: 3-way semi-balanced.

Call your Taylor Field Engineer, or write Taylor-Emmett Controls, Inc., Akron, Ohio, or Taylor Instrument Companies, Rochester, New York.

*Trade-Mark

Taylor-Emmett Controls, Inc.
A SUBSIDIARY OF Taylor Instrument Companies

from glass-reinforced polyester resins has been introduced commercially by DEK Mfg. Co. The unit can be installed in 2-3 hours, and adds but 200 pounds to the gross weight. A five-inch innerspring mattress, plus a built-in fan in the roof adds to the comfort of the sleeping compartment.

For its actual construction, special gel coats and lay-up resins were developed by Interchemical Corp.'s finishes division. Rigorous field tests and usage over a period of several months reveal such advantages as sound deadening, insulation, and high strength properties. The cab can be transferred from one chassis to another, or removed completely for the insertion of a filler panel. This latter factor is expected to enhance resale value.

Readers' Service Item 201

Wash-basin top of ceramic tile held together by epoxy grout.

Epoxy Grout for Ceramic Tile

A non-staining epoxy grout for ceramic tile used in counter tops and similar applications has been introduced by Houghton Laboratories, Inc. Called Resist-Stain, the grout offers outstanding adhesion; bond strengths to a glazed surface, 310 lbs./sq.in.; vitreous tile, 465 lbs./sq.in.; and absorptive tile, 890 lbs./sq.in. Intensive tests have proven the material resistant to coffee, ink, fruit juices, iodine, alcohol, vinegar, and many other household liquids.

A two-part kit, the hardener should be mixed thoroughly with the resin for at least four minutes. This mixed grout is then worked into joints with steel spatula or trowel. No more than 15 minutes should elapse from the time of mixing. Excess grout is removed by scraping diagonally across the tile facing. For clean-up, a small amount of Resist-Stain Clean-Up Solvent is sponged along the joint of cushion-edged tile, or diagonally across the joint of square-edged tile. If a surface haze is detected after 24 hours, the tile should be wiped with a sponge and abrasive cleaner.

Vinyl film can be used to cover the surface during cure, since it will not adhere to the epoxy. The grout will harden in 2-4 hours, can be handled in 24 hours, and cures ultimately in seven days.

Readers' Service Item 202

Expanded polystyrene boat.

Expanded Polystyrene Boat

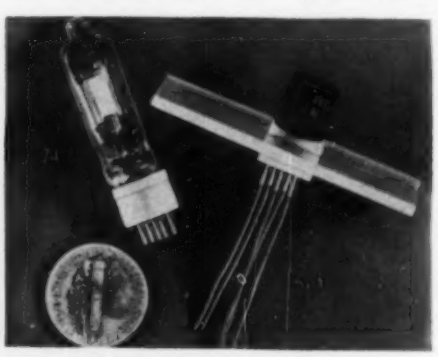
A lighter-than-cork boat made from Koppers' Dylite expanded polystyrene was a big hit this past summer. Introduced by the Jay V. Zimmerman Co., the craft can be filled completely with water and still support a 250-pound occupant. Called the Z-Boat, it measures five feet long by two feet eight inches wide. Weight is a mere 15 pounds.

The Z-Boat is available in two color schemes. Propellable by hands or paddle, it makes a versatile dinghy or safety raft. Unlike an inflatable craft, there can be no valve leakage or puncture. Price is reportedly low.

Readers' Service Item 203

Low-Loss Transistor Socket

A Teflon-insulated transistor socket, designed specifically for the high-reliability requirements of missile guidance and military electronics, is available from Fluorocarbon Products, Inc., a division of United States Gasket Co. Of compression-mounted design for assembly time and cost saving, the sockets are tradenamed Chemelec as is the firm's entire line of electronic components. Featuring low-loss, the sockets are also suitable for subminiature tubes with in-line leads and for printed circuitry.



Teflon-insulated transistor socket.

Readers' Service Item 204

Snap-In Nylon Terminal Bushing

Heyman Mfg. Co.'s new Heyco Junction-Terminal Bushing is actually a miniature nylon receptacle to which quick-connect or disconnect is accomplished easily with standard $\frac{3}{16}$-inch female terminals. It provides access through housings without "pig-tail" wire leads or screw terminals. It also offers control component snap-in, rapid motor hookup, and ease of output change or reverse rotation.

Three types of brass terminals are available: solder, crimp, and double disconnect. The wire is fastened to the permanent end of the terminal, which is snap-fastened into the nylon Heyco. Bushings are color-coded in blue, green, yellow, white, black, red, and brown. Nylon used for the application is Du Pont's Zytel.

Heyco nylon terminal bushing.

Readers' Service Item 205

Plastics and Glass Cleaner

A combination cleaner, water-repellent, anti-static compound for plastics and glass has been introduced by Beaver Laboratories, Inc. Called GTC-59, the liquid is approved by the U. S. Air Force for use on electron-optical systems where the combination of glass, plastic, and static fields present unusually complex cleaning problems.

GTC-59 cleans and degreases in one operation. Containing no caustics or abrasives, it deposits a smooth film on any smooth surface. Static and carbon-dust build up is prevented, and dirt is repelled 10 times longer than with any other type of glass maintenance product.

New Literature

Write item numbers on Readers' Service Card to obtain more information.

"How To Do a Better Job as an Injection Molding Machine Operator." Polymer Products division, Foster Grant Co., Inc. 18 pages. The 38 illustrations and accompanying text explain the steps in injection molding, the machine parts, and the removal of sprues and runners. Finished items are shown which have shorts, flash, sink marks, bubbles, discolorations, or which are distorted. Check points are given for easy recognition of mechanical difficulties.

Readers' Service Item 207

"Products of Dow Chemical Co., Their Properties and Uses." No. 160-A. Dow Chemical Co. 38 pages. The properties and uses of 375 industrial, pharmaceutical, and agricultural chemicals are listed in this catalog. The 1958-1959 issue, it is the firm's fourth annual listing.

Readers' Service Item 208

"Nylatron GS." National Polymer Products, Inc. 4 pages. Property advantages of molybdenum-fortified nylon are described, along with applications, cost, and molding advantages.

Readers' Service Item 209

"Dow PVC Resins." Bulletins 171-111, 171-114, 171-115, 171-116, and 171-117. Five four-page bulletins plus 4 pages of explanatory text. The first booklet decribes and lists properties for the firm's PVC 100-4, 144, 111-4, and 133-4 resins. The other four list specific processing data for the following four PVC resins: 144, 111-4, 100-4, and 133-4.

Readers' Service Item 210

"1958 Directory of Special Tooling Services." National Tool & Die Manufacturers Association. 76 pages. This pocket-size directory lists more than 1,000 contract tool and die plants in the United States, address, person to contact, and their specific products and services.

Readers' Service Item 211

"Poly-Preg 91-LD Impregnations." U. S. Polymeric Chemicals, Inc. 16 pages. Specifications, uses, fabrication procedures, and laminate properties are given in this bulletin. Graphic and tabular data are included.

Readers' Service Item 212

"Borden Chemical Products Recommended to Comply with Government Specifications." Borden Chemical Co. 12 pages. Intended for manufacturers working on government orders, the booklet lists approved adhesives, coatings, sealers, vinyl tubing, and various paint ingredients.

Readers' Service Item 213

"Limonene Dioxide." Bulletin No. 96. Becco Chemical division, Food Machinery & Chemical Corp. 6 pages. Properties are listed for this liquid, which combines the reactivities of an internal and an external epoxy group in the same molecule. It is used as a reactive diluent for epoxies, a cross-linking agent in the preparation of alkyds and polyesters, and in glycol ester plasticizers.

Readers' Service Item 214

"Fluorosint TFE Resin." BR-9. Polymer Corp. of America. 4 pages. Available in molded parts, the resin is designed to improve mechanical and thermal properties of pure polytetrafluoroethylene without damaging its electrical and chemical characteristics. Properties are tabulated and graphed.

Readers' Service Item 215

"Dicyclopentadiene Dioxide." Bulletin No. 95. Becco Chemical division, Food Machinery & Chemical Corp. 6 pages. A diepoxide, the material can be dissolved in liquid epoxy resins or other Becco epoxy chemicals where it crosslinks with the resin or the cross-linking agent. It is used also in alkyds, polyesters, and plasticizers.

Readers' Service Item 216

"Steelmaster Granulators." Bulletin S258. Ball & Jewell, Inc. 4 pages. In addition to the new heavy-duty granulator, the bulletin illustrates and describes the special extrusion hopper which permits the former to handle pipe and other long extrusions up to eight inches in diameter.

Readers' Service Item 217

"Products for the Plastic and Allied Industries." Chemical Development Corp. 12 pages. Covered herein are the firm's adhesives, coatings, antistatic agents, cleaners, lubricants, and other products used in the plastics industry.

Readers' Service Item 218

"Hotwatt Precision Cartridge Heating Units for Clean, Fast, Concentrated Heat." Hotwatt, Inc. 12 pages. This catalog describes the firm's line of cartridge and ceramic heating units. Sizes range from ¼-inch in diameter up to meet customer specification.

Readers' Service Item 219

"Poly-Preg Tacky Low-Pressure Silicone Impregnations." U. S. Polymeric Chemicals, Inc. 5 pages. The material in question, Grade S-890, is a silicone-impregnated fabric with tack and drape at a low residual volatile content.

Readers' Service Item 220

"Plastics for Electronics." Emerson & Cuming, Inc. 4 pages. This short-form catalog gives brief descriptions of Eccodorb microwave absorbers, Stycast casting resins, Eccofoam, Eccostock rods, Ecco reflectors and lenses, Eccocoat coatings, and Eccobond adhesives.

Readers' Service Item 221

"This Is Du Pont." E. I. du Pont de Nemours & Co., Inc. 54 pages. A pictorial history of the Du Pont corporation, it points out personnel, plants and facilities, products, and futures.

Readers' Service Item 222

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Book Reviews

"A Disposable Plastic Paraffin Embedding Box for Histological Work." P. R. Joram, National Institute of Health. Order PB 131397 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 16 pages. Price, 50c.

The box is vacuum formed using a thin cellulose acetate sheet over a simple wooden mold. The container is described as being simple, inexpensive, and efficient. Transparency of the plastic makes the tissue visible on all surfaces as it is embedded. Actual technique is described and illustrated.

"Synthetic Detergents and Emulsifiers." John W. McCutcheon. John W. McCutcheon, Inc., 475 Fifth Ave., New York 17, N.Y. Paper, 8½ by 11½ inches, 78 pages. Price, $2.50.

This booklet is a reprint of an article appearing in the December 1957, January, February, March, and April 1958 issues of Soap and Sanitary Chemicals magazine under the title, "Surfactants Listed." The first two pages contain a general summary of the synthetic detergent field and its most recent developments. This is followed by 75 pages of tabular data giving an alphabetical listing of more than 2,000 U.S. trade name products together with manufacturer, class, formula, main use, form, per cent concentration, type, and other remarks. About 250 manufacturers, whose products are described, are listed in the appendix.

"Polyaethylene und Andere Polyolefine" (Polyethylene and Other Polyolefins), by Harro Hagen. Published by Verlag Brunke Garrels, Hamburg-Wandsbek, Germany. Artificial leather, about 8¼ x 6 inches, 236 pages; price, 22 DM.

The rapid development of the production and use of polyethylene suggested the need for a concise presentation of its properties and the processing methods that have been developed for it. This, the author has undertaken to do in a number of short chapters arranged under five main heads. Methods of producing polyolefines are described in the first main section, starting with the basic materials and going through the Ziegler, Natta, American and other polymerization processes to the irradiation of polyethylene. In the second part, "Chemical and Physical Properties," structures and properties of the different types of polyethylene are compared. Compatability with other plastics, effect of fillers and plasticizers, and chemical and physical effects are covered in ensuing sections.

About half the book is devoted to the various ways in which polyethylene is processed and the equipment used, with incidental mention of applications. Extrusion, sheet forming, production of bottles and containers, vacuum processing, flame spraying, welding, and production of thread and foam are all dealt with. Chlorinated and sulfo-chlorinated and other chemical derivatives of polyethylene are treated briefly in the short fourth section, while the concluding part deals with the application of various polyolefines and includes indexes of firms and subjects. Each of the individual chapters ends with its relevant bibliography and list of patents. A number of tables, diagrams and illustrations add to the usefulness of the book.

"Linear Polyethylene and Polypropylene: Problems and Opportunities." Polymer Associates, 6613 Wenonga Road, Kansas City, Mo. Paper, 8½ by 11 inches, 159 pages. Price, $13.50.

Directed to businessmen in the plastics industry, this industrial study of linear polyethylene and polypropylene was prepared after six months of extensive research by nine graduates of the Harvard Business School. Written in language understandable to the layman, this study reviews the basic chemistry of ordered polymers and the significance of the technological methods that have made their production possible.

Properties are compared with those of other plastics; advantages and disadvantages of specific applications are cited; and several fabricators' case histories with these materials are analyzed. Manufacturer-fabricator relationships are discussed and future uses of linear polyethylene and polypropylene as well as their impact on conventional plastics are analyzed. This book includes a glossary of technical and fabrication terms.

"Ceramic Fabrication Processes." Edited by W. D. Kingery. The Technology Press and John Wiley & Sons, Inc., 440 Fourth Ave., New York 61, N. Y. Cloth, 8¼ by 10¾ inches, 235 pages. Price, $9.50.

This work represents the combined efforts of 22 scientists and engineers who, actively engaged in particular phases of ceramic processing, were brought together in 1956 to conduct a special summer program at Massachusetts Institute of Technology. The compilation gives a comprehensive treatment of both traditional and novel ceramic methods, and provides a sound basis for selecting and using proper fabricating techniques.

New high-temperature materials, ferrites, ferro-electrics, as well as other special ceramics, which are important in the development of electronics and high-temperature devices, are considered. Divided into six sections, special topics include evaluations of: slip casting, the art of preparing stable suspensions and forming ware by building up a solid layer on the surface of a porous mold which sucks up the liquid phase by means of capillary forces; pressure fabrication, which treats on the effects of particle sizes and distributions, problems and controls for production dry-pressing, vibrational compaction, and hydro- or iso-static pressing; plastic forming, deals with the properties of clay-water pastes, particle orientation, and forming of non-clay compositions; drying and firing, discusses sources of drying and firing shrinkage, and solid-state sintering and vitrification processes; some special processes, including hot pressing, cementitious bonding, and nucleation; and ceramic microstructures, where the relationship of microstructure with electrical, magnetic, and mechanical properties within the confines of present-day research are reviewed.

"Applied Mathematics for Engineers and Physicists." Louis A. Pipes. McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Cloth, 6¼ by 9¼ inches, 723 pages. Price, $8.75.

In this work, the author presents some of the more common mathematical techniques used in the analytical formulation of problems arising in engineering and the physical sciences. While space limitations have prevented the complete development of all topics, the treatment is sufficiently rigorous to satisfy most readers and a wide variety of methods are demonstrated clearly. Following each chapter is a list of references to expedite further investigation.

A revised form of the work which appeared in 1946, the author has retained most of his original material and has expanded the chapters on matrix algebra, Fourier methods, variational methods, Laplace transforms, and nonlinear differential equations. Several of the topics normally associated with advanced calculus are treated including infinite series, partial differentiation, and Gamma functions. Differential equations, difference equations, Bessel functions, and Legendre polynomials, as well as partial differential equations are given a comprehensive review. The chapter on vector analysis also has been expanded to include a section on Cartesian tensors.

Nearly every topic is introduced by an example to demonstrate its interest to the applied scientist, and practice problems are included at the end of each chapter.

Abstracts of Important Articles

Materials

"Viscosimetric Characterization of Polyvinyl Chloride Acetate Copolymers," G. Ciampa and P. L. Sbrolli, *Materie Plastiche*, 23, 9, 747. (Sept. 1957).

The properties of polyvinyl chloride-acetate copolymers are closely related to their molecular weights, as indicated by values obtained by different viscosimetric methods. However, these values are not directly comparable. The authors report on results of a number of measurements made according to various current viscosimetric systems on a series of copolymers having the same compositions, but differing molecular weights, and offer tables and graphs to facilitate this comparison. (In Italian.)

"Laminates with Inorganic Fillers," N. W. Knewstubb, *Trans. Plastics Inst.*, 26, 63, 10 (Jan. 1958).

The organic and inorganic fillers for flat laminated sheets, and various combinations of these fillers with pheholic, melamine, silicone, epoxide, p.t.f.e., and polyester resins, as well as laminates containing metal, are discussed. The laminates with inorganic fillers are compared, and brief mention is made of machining methods.

"Four Modern Plastics of Industrial Interest," E. Wanderberg, *Kunststoff-Rundschau*, 4, 9, 392 (Sept. 1957).

Review of properties, types, and applications of silicones, epoxy resins, polyester resins, and polyethylene. (In German.)

"Ageing and Plasticizer Stability in Plasticizer PVC Moisture-proofing Sheet," K. Lufsky, and M. Zopfel, *Plaste u. Kautschuk*, 4, 8, 283 (Aug. 1957.)

To determine the value of soft, plasticized PVC sheets as moisture-proofing material for buildings, its behavior was compared with that bitumen in similar applications. PVC sheets and bitumen both soon show signs of ageing when exposed to weather and biological influences. Enclosed in massive structural parts, bitumen seals are known to have shown no signs of ageing after 50 years and more, and it is assumed that PVC in similar circumstances would behave in the same way. Some justification for this assumption is found in the fact that in comparative tests of the effects of sea-water and sea air on steel coated with PVC and bitumen, PVC proved to be superior. Plasticizer migration and stability tests carried out under severe conditions to reduce time, also are described. (In German.)

"The Influence of Formulation on the Processing of PVC Compositions," R. Hammond, *Trans. Plastics Inst.* 26, 63, 49 (Jan. 1958).

How the trends in development of PVC technology are affected by the formulation of PVC compositions are shown by various examples. The author examines the relation of the particle characteristics of general polymers, copolymers, and paste polymers to processing conditions and ultimate quality, as well as the effects of plasticizers, foamed PVC, and stabilizers.

"Mechanical Properties and Chemical Structure of Macromolecular Substances," J. H. Heijboer, *Plastica*, 10, 11, 824; 11, 1, 34 (Nov. 1957 & Jan. 1958).

The relation of chemical structure and mechanical properties is explained, with due consideration given to processing. The effect is discussed of aggregation state, and the connection between elasticity modulus and temperature, with reference to linear amorphous polymers, cross-linked structures, and crystalline polymers. (In Dutch.)

"Analysis of Polyester Resins with the Aid of Paper Chromatography," Arndt and H. J. Schenck, *Kunststoffe*, 48, 3, 111 (March 1958).

Analysis of commercial polyester resins has been difficult and time-consuming because of the presence of mixtures of aromatic and aliphatic, saturated and unsaturated dicarboxylic acids, as well as of various glycols. The authors describe a simple method for the quantitative separation of dicarboxylic acids and eight glycols. (In German.)

"Development of Paper Chromatographic Techniques," A. D. Clarke and G. Bazill, *Brit. Plastics*, 31, 1, 16 (Jan. 1958).

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in February. The last listing appeared in the October issue.

A method was developed for identifying plasticizers in PVC compounds, and involves paper chromatography of the acids and alcohols obtained by hydrolysis of the extracted plasticizer. With certain limitations, it was found possible, by this means to identify sebacates, azelates, adipates, phthalates, and benzoates, in the presence of most commercially-available plasticizers.

"Evaluation of Carbon Black Dispersions in Polyethylene to Predict Weatherability," R. M. Schulken, Jr., G. C. Newland, and J. W. Tamblyn, *Modern Plastics*, 35, 12, 125 (Aug. 1958).

A Wire & Cable Symposium paper presented last December, this article gives results obtained with a Photovolt transmission densitometer for evaluating the degree of dispersion of carbon black in polyethylene. Good correlation was found between the weathering resistance and white-light absorptivity of such films.

"Ultraviolet Absorbers Mean New Life for Plastics," J. A. Weicksel, *Plastics World*, 16, 8, 8 (Aug. 1958).

Test results are given for use of an ultraviolet absorbing agent in PVC, ethyl cellulose, cellulose acetate, and modified alkyd films.

"The New Polyethylenes, Part 2—Moldings and Extrusions, Film, Fiber, Sheet, Coatings," M. W. Riley, *Materials Design Eng.*, 48, 2, 96 (Aug. 1958).

Report on the current status of the polyethylenes, with tabulated and diagrammatic data.

"Medium Density Polyethylenes," F. C. Sutro, Jr., *SPE J.*, 14, 8, 29 (Aug. 1958).

A short article dealing with the importance of the medium-density polyethylenes, with special attention to their melt index, stiffness, gas permeability, liquid permeability, and softening temperature properties.

"Internal Strains in Casting Resins," R. N. Sampson and J. P. Lesnick, *SPE J.*, 14, 8, 33 (Aug. 1958).

A new method for studying internal stresses is described that employs a specially-designed strain sensing device.

"The Determination of Moisture Permeation Rate Through Polyethylene Cable Glands," D. W. Glover and A. J. Cleaver, *Brit. Plastics*, 31, 3, 105 (Mar. 1958).

Repeaters for British long-distance submarine telephone cables, needed to maintain signal strength, are housed in steel cases provided with water-excluding glands. To insure that moisture leakage does not exceed the tolerated maximum, two new methods, and the apparatus, for determining moisture-entry rate in model glands molded without a center conductor are

described. One method employs a dew or frost point thimble for periodical frost-point observation, while the other uses tritium oxide as a radioactive tracer.

"Supersonic Examination of Plastics by the Impulse Method," W. Grabendorfer, *Gummi-Asbest*, 10, 10, 544 (Oct. 1957).

Supersonics may be applied to testing of plastics either to detect defects or to examine material constants. How this is effected by means of the Impulse Reflection apparatus is explained by some examples. The difficulties that may be encountered because of the nature or shape of the samples of plastic are considered. A simple trick to facilitate testing of small samples is described. (In German.)

"Polymerization with Radiation. Part I—General Considerations," R. F. Boyer, *SPE J.*, 14, 9, 47 (Sept. 1958).

The beginning of a two-part article discussing the application of ionizing radiation in polymerization, cross-linking, and graft copolymerization with respect to economics, comparison with conventional chemical methods, and other considerations.

"Measurement of PVC Brittle Point," H. O. Williams, *Brit. Plastics*, 31, 3, 107 (Mar. 1958).

An improved method for measuring the cold-crack temperature for PVC sheet and coated fabrics employs apparatus including a spring-loaded plunger that strikes an anvil upon which the folded test piece is placed. The anvil and end of the plunger are immersed in alcohol in a small brass bath, the liquor is cooled by adding solid carbon dioxide and is stirred mechanically. Procedure and test results are discussed. Advantages of the method claimed are good reproducibility; speed, since the bath is small enough to allow rapid changing of temperature; and the short immersion time (15 seconds) that avoids the danger of plasticizer extraction.

Processing

"Extrusion of Clear Film from High Density Polyethylene," Robert Doyle, *SPE J.*, 14, 6, 35 (June 1958).

Description of a simple water-bath quenching process for producing a light-gage film. Film properties are outlined.

Applications

"The Use of Thermoplastic Materials in the Construction of Acid-Resistant Plant," H. P. Zade, *Plastics (London)*, 23, 245, 72 (Feb. 1958).

Examples of the application of plastics in the construction of acid-resistant plant are described, including fume cupboards employing rigid PVC, epoxy, and Perspex; an all-PVC pickling plant; etching benches with polyethylene-lined steel bases; a vertical centrifugal PVC pump; a rigid PVC ball valve with Fluon gaskets, and Ehrlenmeyer flasks of a Ziegler-type polyethylene.

"Closures for Boxes made of Plastic Foil," H. Behringer, *Kunststoffe*, 48, 2, 97 (Feb. 1958).

A plastic container for food, which has a welded-on cover, is cheap to produce and is sealed hermetically. However, it poses various problems to the producer and often is unpopular with the ultimate consumer because it is difficult to open. The problems are discussed and alternate closures suggested in which the covers are attached mechanically to the boxes so that they are removed easily by the user. (In German.)

"Wood, Steel or Plastics?" J. O. W. van Dugteren, *Plastica*, 10, 10, 664; 10, 11, 818; 10, 12, 935 (Oct., Nov., Dec. 1957).

After comparing the relative advantages of plastics, steel, and wood for boat-building the author first surveys progress in plastic boat-building in the Netherlands, giving attention to the principles of construction. After this, foreign developments are considered, especially in England where many firms are making plastic lifeboats. The author describes in detail the products of two English ship-builders he visited, stressing the very superior finishes of boats built by one of the firms. (In Dutch.)

"Combination of Different Packaging Materials," H. Berger, *Kunststoffe*, 48, 2, 54 (Feb. 1958).

How the properties of paper, cellophane, and PVC film packaging materials can be improved considerably by combination with polyethylene, polyvinylidene, and aluminum is explained briefly. A table gives the latest data on the properties of individual materials, including aluminum foil. (In German.)

"Polyethylene for Flexible Packaging," D. D. James, *Plastics Industry*, 16, 6, 22 (June 1958).

A brief discussion of polyethylene for flexible packaging, with emphasis on the role played by the base resins in forecasting stiffness, and the need for film toughness, density, and shrinkage-resistance.

"The Use of Plastics in Latex Form." J. Brydon, *Plastics (London)*, 23, 244, 11; 23, 245, 62 (Jan. & Feb. 1958).

The nature of plastic latices is discussed, as well as the commercial types available in Great Britain, including latices based on polystyrene and copolymers, polyvinyl acetate and copolymers, PVC and copolymers; polymethacrylate and copolymers; and p.t.f.e. This is followed by a description of compounding ingredients, and of applications of latices in flooring, adhesives, paints, wire coating, textile and leather finishes, film forming, glass fiber impregnation and paper treatment.

"Astralon in Cartography," R. Walter and J. Becke, *Kunststoffe*, 48, 3, 141 (March 1958).

Several grades of sheets and foils for a variety of purposes are produced from Astralon, a vinyl copolymer, including a special kind for use in cartography. The properties that make this material particularly suitable for the purpose are dimensional stability, transparency, surface structure, and resistance to aging and corrosion are discussed, as well as the possibilities it offers because of the ease with which it can be drawn on and engraved, and because it lends itself to photo-mechanical copying processes. (In German.)

"Polyester House for Five People," H. Brendel, *Plastverarbeiter*, 8, 8, 287 (Aug. 1957).

Sketches and a photo of a plaster model accompany a description of the construction of a house for five people which is to be assembled in building-block fashion from prefabricated panels of polyester resin laminate. (In German.)

"Development and Use of Plastics in the Building Industry," R. Walter and D. I. Frenz, *Plastverarbeiter*, 8, 8, 282 (Aug. 1957).

Application of plastics inside and outside buildings are reviewed, including floorings, hand-rails, moldings, channeling, curtains, water pipes, roofing, and furniture. (In German.)

"New Closures for Plastic Containers," M. Parducci, *Materie Plastiche*, 23, 8, 665 (Aug. 1957).

Recently patented Monostop and Monospray plastic closures, intended chiefly for polyethylene containers, are described. As its name implies, the "Monospray" closure is designed to function as an atomizer. Modifications of both types are available for use on polyethylene and PVC bag-shaped containers. (In Italian.)

"Large Building Components of Molded Reinforced Plastics," C. Pea, *Materie Plastiche*, 23, 8, 637 (Aug. 1957).

At the Milan Fair held in April 1957, an experimental plastic house, designed by the Italian architect, Cesare Pea, attracted much attention. In the present article, Mr. Pea discusses the problems involved in designing similar houses to be assembled from elements of molded reinforced plastics that can be mass-produced and can be combined in different ways to suit specific needs and to avoid monotony. The structures would be intended primarily for sports communities, the military, campers, and the like. (In Italian.)

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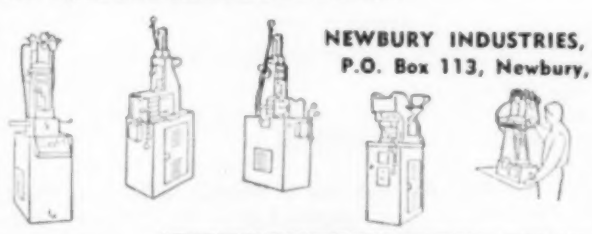

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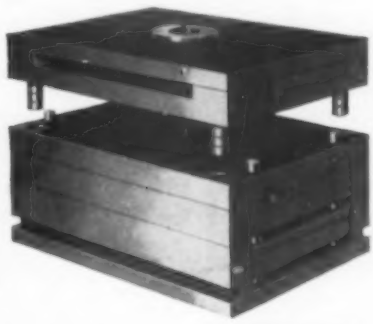

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Patent Digest

Materials

Production of Acrylonitrile from Hydrocyanic Acid and Acetylene. No. 2,838,134. Irving F. Anderson, Chesterfield County, and Robert F. Butler, Hopewell, Va. (to Allied Chemical Corp., New York, N. Y.).

Monovinylacetylene is scrubbed with kerosene from acetylene-rich recycle gas. The spent kerosene then is flashed at low temperature and pressure to recover a major part of the dissolved acetylene. The kerosene finally is stripped from the monovinylacetylene with steam.

Method for Lubricating Polystyrene Granules and Enhanced Molding Granules Thereby Obtained. No. 2,839,422. Carlton E. Beyer and Robert B. Dahl, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Polystyrene is extruded into a strand and dipped at a temperature of 250-350° F., into an aqueous bath which is maintained at 100-160° F., and contains nonemulsified butyl stearate. When the strand is withdrawn, it has a superficially-diffused coating of butyl stearate in the amount of 0.1-1.0% by weight. The strand is then cut into granules suitable for injection molding purposes.

Cellular Carbon Monoxide-Olefine Copolymer-Polyisocyanate Products and Process of Producing Same. No. 2,839,478. Hugo Wilms, Leverkusen, Otto Bayer, Leverkusen-Bayerwerk, Wilhelm Bunge, Leverkusen, and Ludwig Bruns, Opladen-Lutzenkirchen, Germany. (to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany).

Water and a neutral carbon monoxide-olefine having terminal hydroxyl groups and water and a carbon monoxide-olefine copolymer having terminal hydroxyl and carboxyl groups is reacted with an organic polyisocyanate.

Epoxy Resins Cured With A Fluorine-Containing Anhydride. No. 2,833,681. Samuel J. Nelson and James S. Sconce, Niagara Falls and Paul Robitschek, Wilson, N.Y. (to Hooker Electrochemical Co., Niagara Falls, N.Y.).

A polymerizable composition comprising a glycidyl ether of a polyhydric compound having a 1,2-epoxy equivalency greater than one, and a fluoro-bicyclo heptene dicarboxylic anhydride.

Copolymers of Trifluoroethyl Acrylate. No. 2,834,763. Benjamin D. Halpern, Wolf Karo, and Philip Levine, Leominster, Mass. (to Borden Co., New York, N. Y.).

Addition polymers of at least 88% by weight of trifluoroethyl acrylate with a member of the group consisting of acrylonitrile, acrylamide, and N-alkyl substituted acrylamide.

Redox Type Polymerization. No. 2,834,760. Robert J. Orr and Harry Leverne Williams, Sarnia, Ontario, Canada. (to Polymer Corp., Ltd., Sarnia, Ontario, Canada.).

A conjugated diolefin containing from 4-12 carbon atoms is polymerized in the presence of an iron salt and p-diisopropylbenzene dihydroperoxide.

Preparation of Polyethylene. No. 2,834,055. Gosta Carl Akerlof, Princeton, N.J. (to Callery Chemical Co., Pittsburgh, Pa.).

Solid polyethylene is recovered after subjecting a mixture of ethylene and boron trichloride to an electrodeless discharge.

Arylene Diisocyanate-Fatty Acid Triglyceride-Polyol Cellular Material and Process of Producing Same. No. 2,833,730. Eric Barthel, Jr., New Castle, Del. (to E. I. du Pont de Nemours, Wilmington, Del.).

Arylene diisocyanate, a fatty acid triglyceride having a hydroxyl number of at least 49, and a polyhydroxy compound consisting of selected saturated diols and triols having a molecular weight below 200, are reacted together to produce a cellular plastic material.

Melamine Process. No. 2,833,765. Carroll A. Hochwalt, Clayton, Mo. (to Monsanto Chemical Co., St. Louis, Mo.).

Melamine is prepared by heating together ammonia, hydrogen cyanide, and sulfur at a temperature between 200-450° C., and a pressure from 200-2,000 psig.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

—The Editor

Equipment

Apparatus for Joining Thermoplastic Sheets. No. 2,834,395. Arthur O. Russell and Michael Gravatt Jones, Fredericksburg, Va. (to American Viscose Corp., Philadelphia, Pa.).

Components of this apparatus include a pair of heat conductive bodies disposed in opposing relationship and arranged for relative movement in directions toward and away from each other. Each of the conductors has an elongated extension that projects outward in aligned relationship with the other. Flat, thermally insulated, heat-conductive plates are attached to each extension, and are provided with means for heating and cooling.

Accessory Apparatus for Making Blown Polystyrene Film. No. 2,832,994. Harold G. Ahlich, Midland, and Eugene Habowski, Bay City, Mich. (to Dow Chemical Co., Midland, Mich.).

In association with a tube forming extruder and a pair of pinch rolls disposed with their nip centered transversely on the extrusion centerline, a hollow metal ring is incorporated whose internal diameter is greater than that of the extrusion orifice, but less than that of the inflated tube. The ring has an inlet and outlet for coolant circulation, and a smooth metal bead around its inner face to provide a single circumferential line of contact between the ring and the inflated tube. The ring is mounted coaxially with the die and spaced a short distance from it to serve as a guide for the inflated plastic film tube during operation of the apparatus.

Apparatus for Extruding and Cooling Plastics. No. 2,832,993. Thomas K. Cox, Randallstown, Md. (to Western Electric Co., New York, N.Y.).

An elongated tube, arranged for quick disconnection, is coupled to the exit end of the extruder die. The tube is filled with a pressurized cooling medium and designed so that an article issuing from the die may be advanced directly into and through the tube. An annular heating unit abuts the exit end of the die to prevent the fluid from cooling the die to a temperature where a smooth extrusion cannot be obtained.

Processing

Process of Making Laminated Plastic-Impregnated Tubes. No. 2,833,684. Joseph Horowitz, Hanson, Mass. (to Babbitt Pipe Co., Inc., West Hanover, Mass.).

A solution consisting of 60% phenol formaldehyde resin and 40% alcohol is mixed with a thermosetting polymer composed of 60% vinyl chloride and 40% acrylonitrile, at about 80° F. When sprayed onto paper, the resin penetrates the fibers, as does the copolymer to a lesser extent.

The sprayed paper is baked for about 30 minutes at 250° F. to evaporate the moisture in the paper, eliminate the alcohol, and convert the resin to its "B" stage. The paper is laminated, formed into a tube, and the resin cured at about 1,000 psi., at 340° F. This causes the resin and copolymer to become chemically linked. As a final operation, the tube is baked for three hours at about 300° F.

Method of Electroplating Plastic Articles. No. 2,834,724. Abraham Piza Mendes, New York, N.Y.

The article is first placed in a vapor vacuum chamber where it is coated with a thin film base of antimony, bismuth, or arsenic; after which it is coated with a noble metal by electrodeposition.

Finishing Polyester Fabrics. No. 2,828,-528. Navin J. Gajjar, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Wilmington, Del.).

Polyethylene terephthalate fabric is deformed by an evenly-distributed compressive force and heat-set at a temperature between 250°-450° F. Following this, the fabric is immersed in an aqueous alkaline solution until it has lost 5% of its weight, after which it is washed and dried.

Reinforced Corner for Plastic Sheets and Method of Making Same. No. 2,826,-240. George D. Meier and George E. Kloote, Grand Rapids, and Joseph A. Potchen, Marne, Mich. (to Haskelite Mfg. Corp., Grand Rapids, Mich.).

A laminated panel containing an internal, light-weight, cellular body with a facing sheet is reinforced by first removing a triangular shaped piece from the cellular material at the corner, filling the cavity with an adhesive, covering the filled cavity with a fitted strip, and curing the adhesive to make a rigid, shock-resistant, form.

Method for Producing Foamed Plastic Spools. No. 2,829,400. Louis H. Morin, Bronx, N. Y. (to Coats & Clark, Inc., New York, N. Y.).

A cavity mold is partially filled with foamable plastic and sealed. The cavity is sealed and the material is heated with hot gas to fuse and expand it to fill the mold thus forming a spool body having a rim-engaging means on each end. After the spool is cooled and released from the mold, an annular plastic rim is cast on each end at the rim-engaging means.

Method of Extruding an Aqueous Particulate Dispersion of Finely Divided Cellulose. No. 2,829,944. Ray Clyde Houtz, Barrington, Ill., and James Herbert Werntz, Wilmington, Del. (to E. I. du Pont de Nemours and Co., Wilmington, Del.)

The dispersion consists of at least 60% cellulose having an average particle size less than 300 microns in diameter, and contains a water soluble, polymeric film forming material. It is extruded through a die to form a shaped article which is immersed in a salt solution capable of dissolving the natural polymer. After the cellulose particles have coalesced, and before the article loses its shape, it is removed from the bath and washed free of the salt.

Applications

Protective Garment. No. 2,830,297. Reinhardt N. Sabee, Appleton, Wis. (to Kimberly-Clark, Corp.)

The bib comprises a sheet of absorbent material with a thermoplastic backing. An attaching tape is disposed across one corner of the side having the backing. The corner is folded over the tape and heat sealed to secure it.

Plastic Material and Method of Preparing Same. No. 2,827,414. Willis A. Bussard and Herbert C. Chan, San Francisco, Calif. (to Tropi-Sales, San Francisco, Calif.).

Polyester resin is injected between layers of glass mat and woven wood, and the combination is bonded under heat and pressure.

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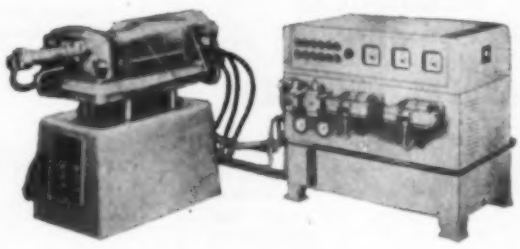

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News Briefs . . .

(Cont'd. from page 1041)

Dow Chemical Co. has announced a reduction of 2¢/lb. in the price of Dow Latex 566. New bulk price is 36½¢/lb. solids contained. The material is a paint vehicle manufactured especially for metal finishing.

Rogers Corp., Rogers, Conn., has named Space Engineering, Pasadena, Calif., to handle its printed circuits, reinforced Teflon, and high-temperature rubbers in California and Arizona.

Goodyear Tire & Rubber Co. has announced an 8% price cut on Vitafilm, a heavy-duty packing material. The new price schedule lowers the manufactured price from 79 to 73¢ per pound.

CALENDAR of COMING EVENTS

Nov. 14-23
Second Plastics Technical Fair and Exhibit. Madrid, Spain.

Nov. 17-21
Eighth National Plastics Exposition. Int'l Amphitheatre; SPI Conference, Hotel Morrison, Chicago, Ill.

Dec. 2-4
U.S. Army Signal Research and Development Lab. Seventh Annual Wire and Cable Symposium. Berkeley-Carteret Hotel, Asbury Park, N. J.

Dec. 3-4
Builders Research Institute. Paints and Coatings. Washington, D. C.

Dec. 6
SPI Southern California Chapter Christmas Party. Huntington Sheraton Hotel, Pasadena, Calif.

Jan. 27-30
SPE 15th ANTEC. Hotel Commodore, New York, N.Y.

Feb. 3-6
SPI 14th Reinforced Plastics Division Conference. Edgewater Beach Hotel, Chicago, Ill.

March 26-27
SPI 16th Pacific Coast Section Conference. Hotel Del Coronado, Coronado, Calif.

Minneapolis-Honeywell Regulator Co.'s ordnance division is using National Aniline's Nacconate 80 isocyanate with Selectron 6002 polyester resin to form a urethane foam packing material for small, irregularly shaped objects. Since the formulation is prepared remote from its point of use, the ingredients are poured into a metal mold which is kept cold with dry ice. Storage time is about eight weeks, and the foam reacts within 25-45 minutes after removal of the dry ice.

James M. Margolis has organized a chemical marketing research service at 10 E. 39th St., New York City. Efforts have been directed toward the chemical specialties, particularly plastics and pharmaceuticals. Mr. Margolis was a research chemist at Dewey & Almy, and more recently sold for Stauffer Chemical Co.

Durable Industries, Inc. is the new corporate name for Blue River Plastics Mfg. Corp., of New York City. The move was dictated in view of the firm's diversified activities, and no other changes are contemplated at this time.

Domestic Production and Sales of Plastics and Resin Material, June and July, 1958

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of June and July, 1958. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

With respect to last months totals, slight decreases are noted in production and sales of cellulosics, phenolics, styrenes, and polyesters. Vinyls, urea and melamines remained about the same, while coumarones and polyethylenes have increased. Grand totals, while lower this month, are about on a par with last year's figures.

	June 1958		July, 1958	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,788,115	1,743,712	1,595,798	1,371,507
Sheets, 0.003 gage and over	1,403,411	1,554,330	1,260,166	1,325,514
All other sheets, rods, and tubes (including other cellulose plastics)	851,287	676,438	640,886	541,373
Molding and extrusion materials (including other cellulose plastics)	6,175,538	5,841,068	6,908,998	6,850,729
Nitrocellulose sheets, rods, and tubes	231,043	244,882	205,070	240,249
TOTAL	10,449,394	10,060,430	10,610,918	10,329,372
Phenolic and Other Tar-Acid Resins:				
Molding materials[2]	11,758,703	11,220,637	8,643,526	11,341,641
Bonding and adhesive resins for—				
Laminating (except plywood)	4,869,009	3,094,686	5,107,657	3,370,422
Coated and bonded abrasives	850,430	822,045	683,700	688,372
Friction materials (brake linings, clutch facings, and similar materials)[3]	1,092,463	1,009,796	740,122	932,618
Thermal insulation (fiber glass, rock wool)	3,424,051	3,584,929	4,304,543	4,706,752
Plywood	4,025,079	3,370,646	3,953,038	3,131,141
All other bonding and adhesive uses	2,786,383	2,833,173	2,674,464	2,757,524
Protective-coating resins unmodified and modified except by rosin	2,119,680	2,296,383	1,516,728	1,790,884
Resins for all other uses	2,369,574	2,006,797	2,459,325	1,941,455
TOTAL	33,295,372	30,239,092	29,993,103	30,660,809
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,396,096	2,269,896	1,808,493	2,052,871
Paper-treating and paper-coating resins	2,002,931	1,977,953	1,821,571	1,859,446
Bonding and adhesive resins for—				
Laminating	2,426,941	2,102,343	1,942,547	2,120,337
Plywood	7,429,787	6,907,995	7,870,751	7,914,027
All other bonding and adhesive uses	784,206	925,737	937,756	1,031,063
Protective-coating resins, straight and modified	2,452,787	2,027,747	2,716,881	1,928,347
Resins for all other uses, including molding	6,008,602	6,109,534	3,559,234	5,162,383
TOTAL	23,501,350	22,321,205	20,657,233	22,068,474
Styrene Resins:				
Molding materials[1]	35,393,707	33,322,369	30,065,650	30,986,400
Protective-coating resins, straight and modified	7,747,935	7,460,564	8,433,986	7,747,663
Resins for all other uses	12,118,817	8,503,164	10,922,625	9,294,066
TOTAL	55,260,459	49,286,097	49,422,261	48,028,129
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		5,986,162		4,770,754
Sheeting (resin content)		5,716,281		5,304,560
Molding and extrusion (resin content)		16,204,724		15,420,387
Textile and paper treating and coating (resin content)[3]		5,461,798		4,882,651
Flooring (resin content)		9,117,289		8,078,168
Protective coating (resin content)		2,518,194		2,526,242
All other uses (resin content)		4,019,724		3,859,670
All other vinyl resins for—				
Adhesives (resin content)		3,931,609		4,058,353
All other uses (resin content)		9,619,580		9,193,625
TOTAL	57,986,479	62,575,361	53,294,195	58,094,410
Coumarone-Indene and Petroleum Polymer Resins	18,116,521	17,807,233	19,016,319	19,714,860
Polyester Resins:				
For reinforced plastics	9,437,472	8,470,452	7,795,611	6,806,091
For all other uses	1,305,897	1,088,554	1,166,112	1,085,011
TOTAL	10,743,369	9,559,006	8,961,723	7,891,102
Polyethylene Resins:				
For film		23,489,478		24,683,978
For all other uses		40,057,999		38,089,962
TOTAL	68,067,887	63,547,477	70,035,418	62,773,940
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding Materials[1,4]	3,622,608	3,596,487	3,373,212	3,210,191
Protective-coating resins[5]	1,523,495	719,402	1,622,626	840,376
Resins for all other uses[6]	11,720,529	10,626,941	11,015,440	10,024,475
TOTAL	16,866,632	14,942,830	16,611,278	14,075,042
GRAND TOTALS	294,287,463	280,338,731	278,602,448	273,636,138

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses. Included with "All other bonding and adhesives uses."
SOURCE: United States Tariff Commission, Chemical Division.

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This listing is as comprehensive and up-to-date as possible. The full listing will appear three times a year, while intervening issues will carry a briefer tabulation of price changes and additions.

Companies whose products do not appear are invited to submit price data for inclusion in the listing. All suppliers are requested to submit product additions and price changes promptly as they occur, in order to make this listing of maximum value to our readers.

Prices, in general, are f.o.b. works. Ranges indicate quantity or grade variations. No guarantee of these prices is made, and spot prices should be obtained from the individual suppliers.

—The Editor

Adhesives

Ampcoflex Adhesive	gl.	$2.75 /	$3.50
Bakelite BC—17613	lb.	.54 /	.84
BCU-40	lb.	.18 /	.48
BR-11938	lb.	.285 /	.585
Bonding resins, abrasives	lb.	.20 /	.915
Brake linings	lb.	.215 /	.6275
Foundry resins	lb.	.2075/	.395
Heat Insul. resins	lb.	.1425/	.37
CD Cement Nos. 200, 201, 202, 203, 204	gl.	.94 /	1.50
PS-7	gl.	2.12 /	2.90
Cymel 401	lb.	.43 /	.45
421	lb.	.40 /	.42
Dow Corning C-271	lb.	1.64 /	1.89
Eccobild 314	lb.	.95 /	1.20
318	lb.	1.30 /	1.75
Epon Adhesive VI, VIII	lb.	3.08 /	3.30
IX	lb.	4.25 /	4.50
Epoxy Adhesive A-1, A-3, A-4	gl.	4.45 /	6.90
A-2, A-5	gl.	5.60 /	8.00
A-6	gl.	5.80 /	8.00
C-1, C-2, C-3, C-9	gl.	5.60 /	8.00
C-4, C-7	gl.	3.69 /	5.30
Flexible Resin No. 1	gl.	4.45 /	6.90
G-E 12316	lb.	.30 /	.39
12353	lb.	.225 /	.385
Melurac 300, 302	lb.	.25 /	.29
301	lb.	.28 /	.33
Metlbond 2002-14	gl.	1.84 /	5.00
4021 Type I	sq. ft.	1.43	
Type II	gl.	1.29 /	3.20
Type III	gl.	1.49 /	3.50
Plaskon Phenolic Bonding Resin	lb.	.16 /	.21
Urea Adhesive 530-11L	lb.	.1875/	.2175
Liquid Adhesive, 2L Types	lb.	.105 /	.115
WR Types	lb.	.0675/	.125
Spray Dried Adhesives	lb.	.18 /	.29
Plastic Cement	gal.	2.25 /	2.70
Pliobond 20	gal.	4.50 /	7.00
30	gal.	5.25 /	8.00
Polyester Foam Cement PC-232	gal.	2.40 /	2.90
Schenectady SP-7401	lb.	.29 /	.31
Schwartz Vinyl Cement	gl.	1.24 /	1.50
Synvarite US #1	lb.	.195 /	.215
Synvarol T	lb.	.125 /	.16
T-3	lb.	.0875/	.1225
T-15, T-15D	lb.	.1275/	.1625
TN, TUN	lb.	.1325/	.1675
TN-231	lb.	.14 /	.175
WR-513	lb.	.0875/	.1225
WR-515	lb.	.0825/	.1175
WR-520	lb.	.0625/	.0925
Styrofoam Adhesive #5	gal.	3.75 /	4.75
Thixon CB	gal.	3.30 /	3.70
CB-2	gal.	3.75 /	3.95
IB	gal.	3.75 /	4.15
NB	gal.	4.05 /	4.45
NM-2	gal.	7.20 /	8.00
Urac 110	lb.	.205 /	.225
180	lb.	.095 /	.12
185	lb.	.1625/	.2175
186	lb.	.0875/	.1125

Anti-Static Agents

Anstac-2M	gl.	1.75 /	2.00
Hanson-Van Winkle-Munning PC-19	lb.	.322 /	.402
PC-52	lb.	.166 /	.246
PC-93	lb.	.288 /	.368
Logostat	gal.	1.35 /	1.65
Merix[3]Anti-Static #79	gl.	.75 /	3.85
#79-OL	gl.	.75 /	3.85

Catalysts

Advance cobalt naphthenate 6%	lb.	$0.4825/	$0.5825
Cobalt tallate 6%	lb.	.4375/	.5375
Advasol	lb.	.4375/	2.5375
Aritemp Curing Agent 105	lb.	2.00 /	.25
Bakelite BH-17618	lb.	.33 /	.63
BHU-53	lb.	.15 /	.45
ERL series	lb.	.67 /	1.195
Cadet benzoyl peroxide, granules	lb.	.98 /	2.00
Paste	lb.	.95 /	2.25
Powder	lb.	1.50 /	2.37
Dichlorobenzoyl peroxide	lb.	3.00 /	4.25
Lauroyl peroxide	lb.	1.90 /	3.50
Methyl ethyl ketone peroxide	lb.	1.85 /	4.00
Catalyst 57	lb.	.12	
196	lb.	.10	
C-110, -180, -180-S, C-110-S, WF-100, -101	lb.	.12	
Celanese accelerators D & E	lb.	.43 /	.50
Benzol peroxide paste	lb.	2.00	
Catalyst MC-1	lb.	2.25 /	2.50
Emerson & Cuming Catalyst 209	lb.	.95 /	4.00
211	lb.	2.25 /	4.50
217	lb.	3.40 /	4.50
Epi-Cure 82	lb.	.82 /	1.60
83	lb.	1.54 /	2.32
84	lb.	2.94 /	3.72
85	lb.	1.125 /	1.905
86	lb.	1.50 /	2.37
87	lb.	.73 /	1.51
Epon Curing Agent BF_3-400	lb.	4.00 /	4.50
C-111	lb.	.6225/	1.10
D	lb.	3.33 /	4.75
T	lb.	.80 /	1.11
U	lb.	.86 /	1.02
Z	lb.	1.265 /	1.56
Linde Chemical-Loaded Molecular Sieves: CW-1015, 1115, 3010, 2015, 3120	lb.	3.00	
Lucidol Catalysts: Alperox C	lb.	1.85 /	3.50
Acetyl peroxide, 25%	lb.	1.75 /	4.00
Benzoyl peroxide, granular	lb.	.98 /	2.00
pastes	lb.	.91 /	3.00
Cyclohexanone peroxide, paste	lb.	2.25 /	2.50
Di-t-butyl diperphthalate	lb.	4.75 /	6.50
Peroxide	lb.	2.00 /	4.00
Hydroxyheptyl peroxide	lb.	4.50	
Methyl ethyl ketone peroxide	lb.	1.85 /	4.00
p-chlorobenzoyl peroxide	lb.	2.50 /	3.50
p-menthane hydroperoxide	lb.	.545 /	2.00
t-butyl hydroperoxide	lb.	2.00 /	3.75
peracetate	lb.	4.00 /	6.00
perbenzoate	lb.	3.00 /	4.75
2, 4, dichlorobenzoyl peroxide	lb.	2.90 /	6.00
2, 5-dimethylhexane-2, 5-dihydroperoxide	lb.	5.00	
Furane H-736-A	lb.	1.30 /	2.00
Marblette Hardener 11	lb.	1.17 /	1.65
16, 661, 680	lb.	1.25 /	1.70
20	lb.	1.17 /	1.40
21	lb.	1.27 /	1.40
41, 665	lb.	1.32 /	1.77
173, 179	lb.	.50 /	.65
645H	lb.	1.15 /	1.70
681, 901	lb.	1.20 /	1.80
900, 903	lb.	2.10 /	2.50
H C Promoter 6%	lb.	.5275/	.6275
12%	lb.	.9025/	1.0025
Het anhydride	lb.	.55	
HN 551	lb.	$0.95 /$	1.40
901	lb.	.36 /	.80
951 Ciba	lb.	.82 /	1.32
951 Furane	lb.	1.30 /	2.00
IC activators		3.00	
Inhibitor	lb.	.98	
Melurac 255, 259	lb.	.35	
Modifier CB-110, WF-61	lb.	.15	
Nuodex Benzyol peroxide 50% paste	lb.	.91 /	2.25
Benzoyl peroxide, 96%, dry	lb.	.98 /	2.00
Cobalt accelerator	lb.	.4875/	3.85
Lauroyl peroxide	lb.	1.90 /	3.50
Manganese accelerator	lb.	.2975/	2.65
M.E.K. peroxide, 60%	lb.	1.96 /	4.00
Paramenthane hydroperoxide, 54%	lb.	.535 /	.55
Silicone catalyst 1, 2	lb.	2.90 /	4.50
P-27	gal.	10.00	
Plaskon Hardeners, Liquid	lb.	.07	
Powdered	lb.	.10 /	.46
Spray dried	lb.	.10 /	.25
Promoter D-2	lb.	1.60 /	2.00
Quick-Set Accelerator 804	gal.	9.80	
Reichhold Hardeners 2600, 2601, 2602, 2603, 2604	lb.	.80 /	1.58
Rezolin epoxy hardeners	lb.	1.14 /	2.50
HN-951	lb.	.86 /	1.74
SA Hardener	lb.	.10	
Sealset 701	gal.	20.00 /	22.00
702	gal.	9.20 /	10.00
703	gal.	18.00 /	19.20
Soligen	lb.	.4825/	.5825

Coating Resins

Acme 150, 160	lb.	2.00 /	2.50
Dispersant A	lb.	.75 /	1.00
Acryloids	lb.	.30 /	.87
Amberlacs	lb.	.2625/	.2875
Amberols, phenolic types	lb.	.2125/	.375
Rosin maleic types	lb.	.21 /	.345
Bakelite Phenolics	lb.	.28 /	.64
Styrene emulsions	lb.	.1375/	.31
Vinyl acetates	lb.	.295 /	.66
Solutions	gal.	5.10	
Alcohols	gal.	2.27 /	2.76
Butyral resins	lb.	1.04 /	1.24
Chlorides	lb.	.41 /	.61
Chloride-acetates	lb.	.38 /	.66
Modified	lb.	.44 /	.72
Celanese PVA emulsions, homopolymers	lb.	.17 /	.26
Copolymers	lb.	.19 /	.28
Chemigum latices	lb.	.46 /	.60
Cymel 243-3	lb.	.3675/	.3925
245-8	lb.	.3275/	.3525
247-10	lb.	.3775/	.3975
248-8	lb.	.3525/	.3775
Dow Corning 805, 808	lb.	1.54 /	1.65
806	lb.	1.85 /	1.98
840	lb.	1.52 /	1.73
Dylex K-500, -600, -700, -900	lb.	.30 /	.46
G-E 13110	lb.	.30 /	.39
Kel-F Dispersion (dry wt.)	lb.	12.00	
Ladcote FHHF-4010, FVHF-4010	lb.	.3575/	.4075
Plaskon Alkyds	lb.	.1075/	.3375
Modified	lb.	.15 /	.2625
Ester Gums	lb.	.1425/	.2475
Maleics	lb.	.1825/	.275
Melamines	lb.	.195 /	.435
Phenolics	lb.	.3925/	.475
Modified	lb.	.1825/	.29
Phenolic Laminating Varnishes	lb.	.165 /	.27
Silicone Alkyds	lb.	1.10 /	2.40
Ureas	lb.	.195 /	.435
Pliolite latices	lb.	.30 /	.39
Pliolite N R	lb.	.93 /	1.22
S-3	lb.	.42 /	.44
S-5	lb.	.49 /	.51
Milled	lb.	.54 /	.56
S-7	lb.	.88 /	1.01
Polyfluoron liquid dispersions	lb.	2.65 /	3.85
Paste dispersions	lb.	4.20 /	4.40
Primer 140	gl.	7.88 /	8.25
Reichhold Coating Resins: Beckacite, floor covering	lb.	.2175/	.2575
Modified phenolic	lb.	.1975/	.2475
Non-phenolic	lb.	.215 /	.3175
Super, pure phenolic	lb.	.2925/	.5825
Beckamine U-F	lb.	.1975/	.35
Super, melamine	lb.	.3275/	.3975
Beckolin	lb.	.2225/	.355
Beckopol	lb.	.2525/	.2625
Beckosol Solutions, epoxy esters	lb.	.37 /	.40
Modified	lb.	.18 /	.23
Non-phthalic	lb.	.16 /	.2325
Phenolated	lb.	.16 /	.2425
Pure-drying	lb.	.1525/	.28
Non-drying	lb.	.205 /	.295
Super, isophthalic	lb.	.2075/	.3025
Epoxy resin	lb.	.595 /	.6975
Hard resin solutions	lb.	.115 /	.195
Hydrogum	lb.	.17 /	.245
Kopol	lb.	.2675/	.2725
Pentacite, non-phenolic	lb.	.17 /	.2425

Plyophen phenolics, alcohol-soluble	lb.	$0.17 /	$0.725
Liquid resins	lb.	.165 /	.20
Powdered	lb.	.30 /	.325
Solution	lb.	.2575/	.2875
Water-soluble	lb.	.111 /	.30
Resin emulsions, alkyd	lb.	.23 /	.27
Wallpol	lb.	.17 /	.23
Styresol	lb.	.2075/	.2475
Synthe-Copal	lb.	.1625/	.20
Wallkyd	lb.	.12 /	.195
Schenectady Alkyds SA Type	lb.	.3575/	.38
SE Type	lb.	.3675/	1.435
SEA Type	lb.	.3575/	.38
Styrenated	lb.	.22 /	.2625
Maleics	lb.	.1725/	.23
Phenolics	lb.	.2325/	.535
Modified	lb.	.1825/	.27
Schwartz AT-25	qt.	.63 /	1.00
BK-40	gal.	3.80 /	3.95
Versamid 100	lb.	.51 /	.69
115	lb.	.64 /	.82

Colors

Acheson 0100 Series Paste Dispersions:			
Blacks	lb.	.50 /	.81
Blues	lb.	.55 /	2.175
Green	lb.	2.51 /	2.69
Orange	lb.	.67 /	.85
Reds	lb.	1.08 /	1.34
White	lb.	.52 /	.70
Yellows	lb.	.57 /	.75
Advabrite M-10	lb.	2.25 /	2.40
Advance Brightener M.D.A.C.	lb.	12.00 /	15.00
Akron Chemical Colors:			
Dry blends, reds	lb.	1.08 /	1.23
Yellows	lb.	.58 /	.88
Organic colors, blues	lb.	.75 /	3.60
Greens	lb.	1.35 /	3.95
Reds	lb.	1.10 /	4.40
Yellows	lb.	2.00 /	5.00
Pastes, blues	lb.	1.25 /	1.58
Greens	lb.	1.85 /	1.90
Reds	lb.	1.10 /	1.40
White	lb.	.55 /	.60
Yellows	lb.	1.70 /	1.75
Cabot carbon blacks:			
Black pearls 2	lb.	.78 /	.87
71	lb.	.36 /	.44
74	lb.	.26 /	.34
81	lb.	.0975/	.17
0	lb.	.135 /	.21
Carbolac 2	lb.	.78 /	.87
Elf O	lb.	.135 /	.21
Elftex 3, 5, 8	lb.	.0825/	.145
Monarch 71	lb.	.36 /	.44
74	lb.	.26 /	.34
81	lb.	.1025/	.18
Sterling R	lb.	.0625/	.125
S	lb.	.0575/	.115
99	lb.	.0725/	.13
Supercarbovar	lb.	.53 /	.61
Cadmolith Reds	lb.	1.72 /	2.20
Yellows	lb.	1.12 /	1.20
California Ink, P. C. color dispersions:			
Black	lb.	.76 /	.77
Blues	lb.	.90 /	2.17
Brown	lb.	.56 /	.57
Green	lb.	2.05 /	2.06
Reds	lb.	.61 /	2.67
White	lb.	.72 /	.73
Yellows	lb.	.62 /	.74
P. C. plasticized boat colors:			
Black	lb.	.76 /	.77
Blue	lb.	1.32 /	1.33
Blue-green	lb.	1.21 /	1.22
Green	lb.	2.12 /	2.13
Red	lb.	2.69 /	2.70
Yellow	lb.	1.71 /	1.71
Carbic Colors:			
Permanent Carmine FBB	lb.	6.16	
Red FGR	lb.	3.07	
Yellow GR	lb.	3.50	
PV-Carmine B	lb.	5.40	
PV-Carmine HR	lb.	6.50	
PV-Fast Orange GRL	lb.	27.27	
PV-Fast Red B	lb.	28.00	
PV-Fast Violet BL	lb.	16.50	
PV-Fast Yellow HR	lb.	5.10	
PV-Orange G	lb.	3.30	
PV-Red G	lb.	4.27	
PV-Violet G	lb.	13.60	
PV-Yellow G	lb.	4.46	
PV-Yellow GG	lb.	4.00	
Claremont 4000-Series Pastes:			
Blacks	lb.	.82 /	1.01
Blue	lb.	.80	
Browns	lb.	.65 /	2.30
Greens	lb.	.80 /	2.15
Orange	lb.	1.58	
Reds	lb.	5.60 /	6.95
Silver	lb.	1.02	
White	lb.	.715	
Yellows	lb.	.65 /	2.87
D-Series pastes,			
Blacks	lb.	.48 /	.64
Blues	lb.	.62 /	1.57
Browns	lb.	.48 /	1.67
Golds	lb.	2.31 /	2.49
Green	lb.	1.78 /	1.88
Oranges	lb.	.71 /	4.27
Reds	lb.	1.10 /	6.36
Silver	lb.	$0.89 /	$0.91
Whites	lb.	.47 /	.60
Yellows	lb.	.56 /	3.70
K-Series pastes,			
Blacks	lb.	.56 /	.71
Blues	lb.	.89 /	1.40
Browns	lb.	.53 /	.55
Greens	lb.	.92 /	1.41
Metallics	lb.	.89 /	2.47
Orange	lb.	.86 /	4.45
Reds	lb.	.99 /	6.85
Violets	lb.	2.28 /	2.30
Whites	lb.	.59 /	.60
Yellows	lb.	.72 /	3.02
Maxiprint Series inks:			
Black	lb.	.50 /	.53
Blues	lb.	.68 /	1.50
Greens	lb.	.68 /	1.10
Metallics	lb.	.67 /	1.20
Orange	lb.	.71 /	.74
Red	lb.	.84 /	1.13
Violet	lb.	1.18 /	1.21
White	lb.	.51 /	.54
Yellows	lb.	.65 /	.68
MB-Series inks:			
Black	lb.	.85	
Blue	lb.	1.25	
Clears	lb.	.65 /	.66
Green	lb.	1.30	
Metallics	lb.	1.20 /	1.25
Orange	lb.	1.05	
Pearl	lb.	1.17	
Red	lb.	1.11	
White	lb.	.68	
Yellows	lb.	.90 /	1.23
MY Series inks:			
Black	lb.	.70	
Blue	lb.	1.25	
Clears	lb.	.57 /	.62
Green	lb.	1.35	
Greengold	lb.	1.90	
Orange	lb.	.85	
Pearlescent	lb.	1.95	
Reds	lb.	1.15 /	2.95
White	lb.	.55	
Yellows	lb.	.75 /	1.35
Mylar printing inks:			
Aluminum	lb.	.99	
Black	lb.	.81	
Blue	lb.	1.18	
Bronze reducing clear	lb.	.51	
Gold concentrate	lb.	1.07	
Green	lb.	1.27	
Hi-viscosity clear	lb.	.69	
Orange	lb.	.97	
Pearlescent concentrate	lb.	1.98	
Red	lb.	1.19	
Reducing clear	lb.	.68	
White	lb.	.53	
Yellows	lb.	.83 /	1.21
PE-Series, granular concentrates:			
Blacks	lb.	.86 /	1.05
Blues	lb.	2.98	
Green	lb.	3.00	
Metallics	lb.	1.27 /	1.66
Oranges	lb.	1.12 /	2.75
Reds	lb.	1.93 /	5.25
Whites	lb.	.70 /	.85
Yellows	lb.	.78 /	5.10
PX-Series pastes:			
Blacks	lb.	1.58 /	2.15
Blues	lb.	1.15 /	2.60
Browns	lb.	1.08 /	1.47
Green	lb.	2.76 /	2.86
Grey	lb.	1.30 /	1.40
Metallic, silver	lb.	1.45 /	1.55
Orange	lb.	1.48 /	1.58
Reds	lb.	2.25 /	3.95
White	lb.	.92 /	1.02
Yellows	lb.	2.05 /	2.55
RP-Series inks:			
Aluminum	lb.	.89	
Black	lb.	.58	
Blue	lb.	1.08	
Gold	lb.	.95	
Green	lb.	1.12	
Orange	lb.	.83	
Pearlescent	lb.	1.87	
Red	lb.	1.08	
Reducing clears	lb.	.47 /	.65
White	lb.	.49	
Yellows	lb.	.71 /	1.09
UR-Series pastes:			
Black	lb.	1.00	
Blue	lb.	1.82	
Brown	lb.	2.00	
Green	lb.	2.20	
Orange	lb.	1.68	
Reds	lb.	1.92 /	3.55
White	lb.	.83	
Yellows	lb.	1.75 /	2.15
VC-Series inks:			
Black	lb.	.56	
Blue	lb.	.68 /	1.15
Clear	lb.	.39 /	.55
Green	lb.	1.155	
Metallics	lb.	.72 /	1.54
Orange	lb.	.68	
Pearl	lb.	1.96	
Red	lb.	1.17	
White	lb.	.37	
Yellows	lb.	.61	
VC-Series inks, arc resistant:			
Black	lb.	.68	
Blues	lb.	.79 /	1.05
Clears	lb.	.51 /	.53
Greens	lb.	.80 /	1.17
Metallics	lb.	$0.74 /	$1.37
Orange	lb.	.81	
Reds	lb.	1.08	
Violet	lb.	.96	
White	lb.	.54	
Yellows	lb.	.69 /	1.15
Columbian Carbon colors:			
Aqueous dispersions			
Aquablak No. 1	lb.	.20 /	.21
3	lb.	.125 /	.135
15	lb.	.115 /	.125
26	lb.	.1025/	.1125
41	lb.	.34 /	.35
B	lb.	.0975/	.1075
G	lb.	.12 /	.13
H	lb.	.23 /	.24
K	lb.	.12 /	.13
L	lb.	.14 /	.15
M	lb.	.11 /	.12
S	lb.	.12 /	.13
U	lb.	.23 /	.24
X	lb.	.11 /	.12
Coloidex No. 3	lb.	.14 /	.21
No. 8	lb.	.16 /	.23
Hiblak AE	lb.	.10 /	.11
Colloidal dispersions			
Coacetateblak CQ-21	lb.	.875 /	.90
Coblac 405	lb.	.90 /	.925
DD Sol	lb.	.70 /	.725
Industrial	lb.	.73 /	.755
Coethloblak CK	lb.	1.03 /	1.055
Coresinblak No. 3	lb.	.76 /	.785
Costyreneblak 903	lb.	.595 /	.62
CJ-21	lb.	.5425/	.5675
Covarnishblak AR	lb.	.6475/	.6725
BK	lb.	.565 /	.59
BJ	lb.	.52 /	.545
Covinylblak BA	lb.	.95 /	.975
BD	lb.	.97 /	.995
BF	lb.	.70 /	.725
BH	lb.	.66 /	.685
BL	lb.	.82 /	.845
BM	lb.	.77 /	.795
CA-18	lb.	1.0725/	1.0975
Cowaxblak BV-25	lb.	.515 /	.54
CB-18	lb.	.6225/	.6475
CM-83	lb.	.485 /	.51
DC Globak	lb.	.80 /	.825
DCV Coblac	lb.	.83 /	.855
Mapico colors, black	lb.	.1475/	.15
Browns	lb.	.1575/	.16
Crimsons, reds	lb.	.1425/	.145
Tans	lb.	.2325/	.235
Yellows	lb.	.12 /	.1275
Electronic Grades:			
110-2, EG-80	lb.	.1425/	.145
EG-1, EG-2	lb.	.2325/	.235
EG-3	lb.	.1575/	.16
Paint Grades			
140	lb.	.1025/	.18
999	lb.	.26 /	.34
Excelsior	lb.	.135 /	.21
Molacco	lb.	.0625/	.125
Beads	lb.	.575 /	.115
Neo Spectra MK I	lb.	.98 /	1.07
MK. II	lb.	.78 /	.87
MK. III	lb.	.47 /	.55
Ravens 11 & 15	lb.	.1025/	.18
Royal Spectra	lb.	1.66 /	1.78
Statex	lb.	.0725/	.13
Beads	lb.	.0625/	.12
Super Spectra	lb.	.70 /	.79
Superba	lb.	.36 /	.44
Continex HAF	lb.	.0725/	.13
SRF	lb.	.0525/	.11
Cyanamid inorganic pigments:			
Cobalt blues	lb.	.28 /	.35
Chrome greens	lb.	.42 /	.44
Oranges	lb.	.35	
Yellows	lb.	.35	
Iron blues	lb.	.52 /	.59
Molybdate chrome oranges	lb.	.48	
Ultramarine blues	lb.	.17 /	.33
Zinc yellow	lb.	.29	
Powders, Unitane-O	lb.	.255 /	.265
Unitane-OR	lb.	.275 /	.285
Organic dyes, Indulines	lb.	.89 /	1.07
Nigrosines	lb.	.65 /	.94
Oil-soluble black	lb.	.68	
Blue	lb.	8.02	
Orange	lb.	1.06	
Reds	lb.	1.49 /	2.28
Yellows	lb.	1.21 /	4.16
Spirit-soluble black	lb.	2.95	
Brown	lb.	5.30	
Orange	lb.	5.87	
Red	lb.	6.41	
Yellows	lb.	4.62 /	4.94
Pigments, alkali blues	lb.	2.38	
Benzildine oranges	lb.	3.30	
Yellows	lb.	.69 /	3.40
Bon reds	lb.	1.50 /	2.00
Carteret red	lb.	.98	
Chlorinated para reds	lb.	1.36	
Clarion orange	lb.	1.65	
Red	lb.	1.35	
Dinitraniline oranges	lb.	1.56	
Fugitive peacock-blue lakes	lb.	1.00 /	1.27
Hansa yellows	lb.	2.20	
Lithol reds	lb.	.98 /	1.03
Methyl violet base toner	lb.	1.76	
	lb.	1.35	
Naphthol reds	lb.	.80 /	.85
Oil orange, Y-239	lb.	1.70	
Orange lakes	lb.	.85 /	.90
PTMA blue	lb.	5.55	

Greens, Lincoln	lb.	$5.30 /	$6.60
Violet	lb.	4.35	
Para reds	lb.	1.15 /	1.21
Phloxine toner	lb.	1.85	
Phthalocyanine blues	lb.	.90 /	3.80
Greens	lb.	3.50 /	3.95
Pigment green	lb.	1.35	
Scarlet	lb.	1.65	
Red Lake C's	lb.	1.25	
Madder	lb.	3.10	
Rhodamines	lb.	6.60	
Toluidine reds	lb.	1.70	
Yellow lakes	lb.	1.22	
Ferro inorganic colors:			
Black	lb.	1.25 /	1.40
Blues	lb.	1.91 /	2.96
Blue-greens	lb.	1.85 /	2.85
Browns	lb.	.90 /	1.31
Oranges	lb.	2.29 /	4.20
Pink	lb.	1.77 /	1.92
Reds	lb.	2.96 /	4.75
Violets	lb.	1.89 /	2.37
Yellows	lb.	1.26 /	2.90
Harwick Stan-Tones, blues			
Dry	lb.	.90 /	3.45
GPE	lb.	2.50 /	2.85
MBS	lb.	2.20 /	2.85
PC	lb.	1.55 /	1.92
PEC	lb.	1.95 /	2.10
Greens, dry	lb.	.82 /	3.95
GPE	lb.	1.60 /	3.00
MBS	lb.	1.15 /	3.42
PC	lb.	1.70 /	2.32
PEC	lb.	1.12 /	2.15
Oranges, cadmium dry	lb.	1.85 /	4.43
Paste	lb.	.78 /	3.08
GPE	lb.	1.20 /	1.27
MBS	lb.	1.25 /	2.82
PC	lb.	.75 /	.80
PEC	lb.	1.95 /	2.20
Reds, cadmium dry	lb.	1.97 /	5.09
Paste	lb.	3.00 /	3.63
Dry	lb.	.69 /	4.60
GPE	lb.	.77 /	3.22
MBS	lb.	1.00 /	3.15
PC	lb.	1.10 /	1.52
PEC	lb.	1.04 /	2.98
Yellows, cadmium dry	lb.	2.80 /	3.18
Paste	lb.	1.77 /	2.07
GPE	lb.	.90 /	3.32
MBS	lb.	1.30 /	2.27
PC	lb.	.55 /	3.50
PEC	lb.	2.40 /	2.65
Hiblak AE	lb.	.095 /	.10
Huber pigments:			
WVEX, EPC	lb.	.0725/	.135
Zeolex 7	lb.	.085 /	.095
23	lb.	.06 /	.07
Interchemical IC Series			
Black	lb.	.56	
Blues	lb.	.75 /	2.10
Browns	lb.	.64 /	.69
Greens	lb.	.90 /	.99
Oranges	lb.	.78 /	.89
Reds	lb.	1.16 /	2.50
White	lb.	.70	
Yellows	lb.	.95 /	1.65
Kentucky Inorganics,			
Orange	lb.	.44 /	.64
Yellows	lb.	.31 /	.66
Organics	lb.	3.00 /	4.15
Greens	lb.	3.50 /	4.60
Purple	lb.	1.85 /	2.05
Reds	lb.	1.95 /	3.85
Kriegr-O-Dip W Types	qt.	2.63 /	7.80
A Types	qt.	1.52 /	2.25
Laminac color pastes	lb.	.76 /	1.90
Mearlmaid Pearls	lb.	14.00 /	25.00
Nacromer Pearls, Series C	lb.	2.15 /	2.25
Series W	lb.	1.50 /	1.60
Plastics Color Co., GP colors:			
Blacks	lb.	.75 /	3.80
Blues	lb.	.445 /	.48
Brown	lb.	1.20 /	2.25
Greens	lb.	.65 /	3.50
Reds	lb.	.65 /	3.50
Whites	lb.	.75 /	1.10
Yellows	lb.	1.15 /	1.95
Dispersant 3000	lb.	.50 /	.70
3005	lb.	.40 /	.60
3007	lb.	.80 /	1.00
3008	lb.	.55 /	.75
Special acrylic pastes:			
Aqua, Ivory	lb.	1.15	
Black	lb.	1.90	
Blues	lb.	1.10 /	1.25
Brown, White	lb.	1.05	
Green	lb.	1.55	
Grey, Pink	lb.	1.25	
Red	lb.	2.45	
Yellow	lb.	1.50	
Transparent acrylic pastes:			
Amber	lb.	1.60	
Green	lb.	1.80	
Red	lb.	1.95	
Violet	lb.	2.00	
Yellow	lb.	1.50	
Pliolite S-5 bases with pigment			
Blacks	lb.	.44 /	.49
Blues	lb.	.62 /	1.48
Greens	lb.	.54 /	.58
Oranges	lb.	.61 /	.63
Reds	lb.	.31 /	1.20
Whites	lb.	.42 /	.44
Yellows	lb.	.43 /	.45
PMS polyester colors	lb.	.85 /	2.85
Polystyrene colors	lb.	.65 /	4.30
Polyester pastes, aqua	lb.	1.65	
Beige	lb.	1.45	
Black	lb.	1.10	
Blues	lb.	$1.20 /	$1.30
Brown	lb.	1.35	
Greens	lb.	1.20 /	1.70
Grey	lb.	1.30	
Ivory	lb.	1.30	
Oranges	lb.	1.80 /	2.05
Red	lb.	2.35	
White	lb.	.80	
Yellow	lb.	1.60	
Polysupra polyethylene			
blues	lb.	.65 /	5.60
Blacks	lb.	.50 /	.80
Browns	lb.	1.48 /	3.30
Greens	lb.	1.82 /	3.55
Ivory	lb.	.65 /	1.00
Purples	lb.	2.10 /	3.30
Reds	lb.	.70 /	6.30
Silver	lb.	1.50 /	2.95
White	lb.	.60 /	.85
Yellow	lb.	1.45 /	4.25
Polystyrene blues	lb.	.50 /	9.20
Blacks	lb.	.50 /	5.30
Browns	lb.	.95 /	2.55
Greens	lb.	.35 /	7.40
Ivory	lb.	.85 /	1.20
Reds	lb.	.35 /	6.40
White	lb.	.60 /	1.05
Yellows	lb.	1.45 /	2.95
R-B-H Pigment Dispersions:			
Blacks	lb.	.66 /	.84
Blues, phthalocyanines	lb.	2.74 /	2.84
Browns	lb.	.82 /	.92
Greens, chrome	lb.	.82 /	.92
Phthalocyanines	lb.	2.35 /	2.45
Orange	lb.	.83 /	.93
Red	lb.	1.88 /	1.98
Whites	lb.	.67 /	.81
Yellow	lb.	.77 /	.87
Resin Plasticizer Pastes:			
Blacks	lb.	.52 /	.695
Blue	lb.	1.65 /	1.67
Green	lb.	1.64 /	1.66
Orange	lb.	.64 /	.71
Reds	lb.	1.27 /	2.06
White	lb.	.51 /	.53
Yellows	lb.	.51 /	.59
Vinyl Extrusion Chips:			
Blacks	lb.	.895 /	1.09
Blues, iron	lb.	1.03 /	1.13
Phthalocyanine	lb.	2.45 /	2.55
Brown	lb.	.83 /	.93
Green, chrome	lb.	.91 /	1.01
Phthalocyanine	lb.	2.46 /	2.56
Oranges	lb.	.825 /	.97
Purple	lb.	3.36 /	3.46
Reds	lb.	1.605 /	1.705
White	lb.	.73 /	.83
Yellow	lb.	.795 /	.895
R-C blacks	lb.	5.50 /	21.30
Browns	lb.	4.375 /	15.75
Reds	lb.	.28 /	15.05
Yellows	lb.	3.60 /	14.05
Reichhold inorganic pigments:			
Blues, iron	lb.	.53	
Milori, pre-wet	lb.	.3625	
Greens, chrome	lb.	.42 /	.44
Reduced 25%	lb.	.19	
Oranges, chrome	lb.	.35	
Molybdate	lb.	.48	
Yellows, chrome	lb.	.35	
Zinc	lb.	.29 /	.34
Rez-N-Dye (dry wt.)	lb.	7.50	
Rona Natural Pearl Essence:			
Radiant	lb.	16.00	
Supreme	lb.	19.00	
Synthetic Pearlescent Pigments:			
100	lb.	2.25 /	2.30
200, 300	lb.	1.30 /	1.45
1000	lb.	2.05 /	2.15
1025	lb.	3.60 /	4.00
2100	lb.	3.30 /	3.45
KY	lb.	6.50	
NLY	lb.	3.40 /	3.50
RAL	lb.	2.15 /	2.45
S5	lb.	6.50	
Saran colors	lb.	.59 /	1.80
Sherwin-Williams Dispersed			
Colors	lb.	.55 /	1.97
Inorganic colors, oranges,			
yellows	lb.	.32 /	.45
Organic colors, blues	lb.	.90 /	3.60
Greens	lb.	1.35 /	3.95
Reds	lb.	.85 /	4.40
Yellows	lb.	.55 /	1.97
Vansul Organic Drys			
Blues	lb.	3.45 /	3.60
Greens	lb.	1.35 /	3.95
Oranges	lb.	2.21 /	3.00
Reds	lb.	.90 /	4.40
Yellows	lb.	2.00 /	2.25
VAP Dry Dispersions			
Black	lb.	1.00	
Blues	lb.	2.90 /	3.60
Greens	lb.	3.20 /	4.05
Oranges	lb.	1.45 /	2.55
Reds	lb.	1.70 /	4.45
Yellows	lb.	1.35 /	2.55
VP-Series Pastes			
Black	lb.	.70	
Blue	lb.	1.65	
Brown	lb.	1.55	
Green	lb.	2.05	
Oranges	lb.	.80 /	2.30
Reds	lb.	1.15 /	2.55
White	lb.	.47 /	.65
Yellows	lb.	.60 /	1.65
VPE-Series Pastes			
Black	lb.	.90	
Blue	lb.	1.85	
Green	lb.	2.10	
Orange	lb.	$1.00	
Reds	lb.	1.45 /	2.30
White	lb.	.90	
Yellows	lb.	1.60 /	2.00
VV Chips			
Blacks	lb.	.90 /	1.30
Blues	lb.	1.00 /	2.25
Brown	lb.	1.60	
Greens	lb.	0.90 /	$2.45
Oranges	lb.	1.00 /	2.15
Reds	lb.	1.40 /	2.70
White	lb.	.65	
Yellows	lb.	.85 /	1.80
Vinylized colors, blacks,			
whites	lb.	.755	
Blues	lb.	1.16 /	1.18
Golds	lb.	1.51 /	1.57
Green	lb.	1.45	
Metallic	lb.	1.15	
Orange	lb.	.83	
Reds	lb.	1.15 /	2.27
Yellows	lb.	.70 /	1.09
Violite 199, green	lb.	2.95	
200, yellow	lb.	3.75	
PL 3-60, blue	lb.	3.25	
18-70, blue	lb.	3.70	
Williams colors & pigments:			
Blacks, iron oxide	lb.	.1425/	.145
Browns, iron oxide	lb.	.1525/	.155
Burnt umbers	lb.	.0775/	.095
Greens, chromium oxide	lb.	.42 /	.4875
Reds, 100 series, 1,000			
series, RY series	lb.	.1375/	.14
Kromas	lb.	.1375/	.15
Yellows, iron oxide	lb.	.115 /	.1225
Witcoblack 12	lb.	.0725/	.14
32	lb.	.1225/	.20
50	lb.	.0975/	.175
100	lb.	.26 /	.34
Pellets	lb.	.26 /	.34
F-1	lb.	.0575/	.12
Hitone	lb.	.36 /	.44
Pellets	lb.	.36 /	.44
Zopaque, anatase	lb.	.255 /	.265
Rutile	lb.	.265 /	.285

Dispersing Agents

Darvan 1, 2, 3	lb.	.22 /	.30
7	lb.	.1875/	.2375
Dewey & Almy Daxads:			
11, 15, 23, 27	lb.	.201 /	.30
11KLS	lb.	.248 /	.35
11SPN	lb.	.1525/	.1575
21	lb.	.08 /	.20
30	lb.	.185 /	.25
Isomul extra	lb.	.30	
Tamol 731	lb.	.185 /	.1875

Fillers

Advaresin CXF	lb.	.49 /	.55
KF	lb.	.38 /	.44
A. F. D.	ton	26.50 /	60.00
Albacar 5950, 5960, 5970	ton	50.00 /	55.00
Aluminum Flake	ton	23.50 /	30.00
Anhydrous calcium sulfate			
W-1320	ton	47.00 /	52.00
Atomite	ton	32.50	
Barytes, No. 1	ton	45.00 /	65.75
Burgess Iceburg Pigment	ton	30.00	
Pigment No. 30	ton	37.00	
Cab-o-sil	lb.	.67 /	.85
Calcene NC	lb.	.036 /	.059
TM	lb.	.0375/	.0625
Camel—CARB	ton	12.00	
—TEX	ton	20.00	
—WITE	ton	32.50	
Cotton flocks	lb.	.12 /	.32
Crown Clay	ton	14.00	
Dixie Clay	ton	14.00 /	34.50
Duramite	ton	20.00	
Emerson & Cuming Filler			
BA	lb.		2.00
English Mica:			
Waterground mica 160			
mesh	lb.	.08 /	.0875
325 mesh	lb.	.0825/	.09
Georgia Kaolin clays:			
Hydrite	ton	26.00	
Flat	ton	25.00	
PD-10	ton	19.00	
PD-121	ton	20.00	
PX	ton	41.00	
Harwick fillers:			
Clays, Champion	ton	14.50 /	37.50
Harwick	ton	20.50 /	57.00
Flock, colored	lb.	.12 /	.26
white	lb.	.14 /	.28
Magnesia, tech	lb.	.055 /	.33
Magnesium carbonate	lb.	.105 /	.155
Mica, dry ground	ton	71.00 /	88.75
Mica, Silversheen,			
160 mesh	lb.	.08 /	.0875
325 mesh	lb.	.0825/	.09
Pecan shell flour	ton	45.00 /	106.00
Silene EF	lb.	.055 /	.065
Stan White 325	ton	11.50 /	24.00
Walnut shell flours:			
100W, 200WD	ton	50.00 /	60.00
200W	ton	60.00 /	70.00
200WB	ton	62.00 /	72.00
325	ton	74.00 /	84.00
Hi-Sil 101	lb.	.10 /	.155
233	lb.	.09 /	.105

Huber Clays:			
Coating grade X-44	ton	$21.00	/ $26.00
Hydrasperse	ton	21.50	/ 34.00
Hi-White R	ton	18.50	
Paragon	ton	14.50	/ 18.50
Polyfil	ton	20.00	
Suprex	ton	14.00	/ 19.00
Water-washed SWW, CWF	ton	12.00	/ 17.00
Kalite	ton	50.00	/ 65.00
Kaolloid	ton	10.50	
Laminar	lb.	.015	
Maglite O	lb.	.2350	
Marinco C	lb.	.105	/ .13
McMamee Clay	ton	13.50	/ 33.00
Minerals & Chemical Corp.:			
Edgar ASP 200	ton	43.00	
ASP 400	ton	24.00	
ASP 600	ton	25.00	
ASP 900	ton	19.50	
ASP 1300	ton	80.00	
Multiflex MM	ton	110.00	/ 125.00
Nytal 200L	ton	27.00	/ 50.00
300	ton	37.00	/ 60.00
Omya BSH	ton	45.00	
Plymouth Cordage Sisal Fibers	lb.	.1825	/ .20
Secco Clay	ton	12.00	
Silene EF	lb.	.06	/ .07
Sno-Brite Clay	ton	12.50	
Snowflake	ton	20.00	
Sparmite	ton	80.00	/ 105.00
Surtex MM	ton	37.00	/ 52.00
Suspenso	ton	33.00	/ 48.00
Tamms Satin Talc	ton	22.50	/ 46.00
Velveteen R Silica	ton	23.00	/ 28.00
U.S. Mica, dry grind	lb.	.04	/ .065
Witcarb P	ton	110.00	/ 140.00
R	ton	120.00	/ 150.00
Regular	ton	56.75	/ 85.00
Wollastonite F-1	ton	28.50	/ 30.50
P-1	ton	27.00	/ 29.00

Finishes

Logoquant colors	gal.	3.25	/ 6.30
Toy gloss, acetate	gal.	2.35	/ 4.30
Metal	gal.	2.45	/ 4.10
Polystyrene	gal.	2.45	/ 4.70

Flame-Proofing Agents

IC-776 Antimony Concentrate	lb.	.495	/ .51
M&T Antimony oxide	lb.	.245	/ .26

Glass Reinforcements

Chrome 60-end Roving:			
FBF-7.1, -7.3	lb.	.40	/ .44
FBF-7.5, -7.7	lb.	.42	/ .46
Garan 60-end Roving:			
FBF-7.2, 7.4	lb.	.42	/ .46
FBF-7.6, -7.8	lb.	.44	/ .48
Vitron 60-end Roving:			
VR-12	lb.	.48	/ .52

Lubricants

Advawax	lb.	.365	/ .39
Baselube	qt.	2.50	/ 4.00
Dow Corning 7 Compound	lb.	5.30	/ 6.50
20 Compound	lb.	1.74	/ 4.95
20 Emulsion	lb.	.90	/ 3.50
36 Emulsion	lb.	1.22	/ 1.40
Mold Release Fluid	lb.	3.20	/ 4.75
Emerson & Cuming Mold Release 522	lb.	9.00	/ 11.00
Garalease 915	gal.	3.80	/ 4.50
GE silicone-emulsions	lb.	1.18	/ 1.74
IC-500	gal.	2.50	
-571	gal.	3.25	
-793-10	gal.	3.40	
IMS sprays, silicone, neutral oil	can	1.37	/ 2.00
Zinc stereate, dry powder	lb.	1.00	/ 2.00
Isochem wax 270	lb.	.295	
Lubrex	lb.	.27	/ .32
Lunn-Lease	gal.	3.80	/ 4.25
M-1 Mold Release	lb.	3.00	/ 4.00
Metasap barium stearate	lb.	.41	/ .46
Calcium 627	lb.	.40	/ .45
Magnesium stearate	lb.	.42	/ .47
Zinc stearate	lb.	.41	/ .46
ML-4 Separating Film	lb.	.30	/ .40
Mold-Ease Concentrate PCR	qt.	2.50	/ 5.85
Mold Release 225	gal.	5.55	/ 6.00
235	gal.	6.00	
Mold-Wiz	gal.	4.00	/ 6.00
Part-A-Part	gal.	3.05	/ 3.75
Partingkote 823	qt.	1.18	/ 2.18
Prepoxy	gal.	7.20	/ 12.80
Plaskon 8406, 8407	lb.	.30	/ .37
8416, 8417	lb.	.35	/ .42
8429	lb.	.40	/ .47
Poly-Lease 77	16 oz.	1.40	/ 1.50
Real-Ease	20 oz.	1.10	/ 1.60
Releasor Wax No. 826	lb.	2.29	
Slide	20 oz.	1.25	/ 2.00
Sprits	20 oz.	1.00	/ 1.25
SS-452	gal.	2.80	/ 4.90
Super King Bomb-Lube	20 oz.	1.75	/ 2.50
Toplube	qt.	2.50	/ 4.00
Vibrin-VPA Parting Agent	gal.	4.25	/ 4.65

Mica

Dry Ground Mica	lb.	$0.04	/ $0.065
Mycalex 385 & 400, rods, 18 in. length		.90	/ 3.35
Sheets, 14 x 18 inches		5.70	/ 22.40
K, rods, 18-in. length		1.80	/ 6.70
Sheets, 14 x 18 inches		11.40	/ 44.80
Supramica 500, rods, 18-in. length		1.08	/ 4.02
Sheets, 14 x 18 inches		6.84	/ 26.88
Waterground Mica	lb.	.08	/ .09

Miscellaneous

Dutch Boy Bentone	lb.	.44	/ .60
Ben-A-Gel	lb.	.98	/ 1.40
IMS Two-Step Mold Surface Saver	Can	1.50	/ 2.00
Isochem Defoamer 711	lb.	.195	
Metasap Water Proofing Agent 569	lb.	.21	
PMS Purging Compound	lb.	.35	
Ultra violet absorber #9	lb.	5.25	/ 5.75

Plasticizers

Abcoflex A	lb.	.80	/ 2.65
B	lb.	.77	/ 2.60
C	lb.	.88	
D	lb.	.83	
Adipol 2EH, 10A XX	lb.	.40	/ .435
BCA	lb.	.43	/ .455
ODY	lb.	.43	/ .465
Admex	lb.	.3325	/ .3625
711	lb.	.3525	/ .3825
744, 745	lb.	.3925	/ .4225
760	lb.	.5725	/ .6025
761	lb.	.4425	/ .4725
562	lb.	.4825	/ .5125
Akron MP	lb.	.305	
Araldite No. 1	lb.	.765	/ 1.55
Arnold-Hoffman butyl oleate	lb.	.26	/ .27
Butyl stearate	lb.	.2275	/ .2675
Barrett dibutyl phthalate	lb.	.30	/ .335
Dimethyl phthalate	lb.	.28	/ .315
Plasticizer 136	lb.	.175	/ .21
Benzoflex 2-45	lb.	.26	/ .29
9-88	lb.	.32	/ .35
Cabflex DDA, Di-OA, DOA, ODA	lb.	.425	/ .455
DDP, Di-OP, DOP, ODP	lb.	.305	/ .335
Di-BA	lb.	.4325	/ .4625
Di-OZ	lb.	.48	/ .51
HS-10	lb.	.44	/ .47
TCP	lb.	.345	/ .375
Celanese Celluflex 21	lb.	.35	/ .375
23	lb.	.3925	/ .4175
112, 179A, 179C, 179EG, Lindol	lb.	.325	/ .36
DBP	lb.	.30	/ .335
DOP	lb.	.28	/ .315
Triphenyl phosphate	lb.	.415	/ .435
Chlorowax 40	lb.	.1525	/ .1825
50	lb.	.1675	/ .1875
70	lb.	.185	/ .25
70-S	lb.	.21	/ .275
LV	lb.	.1725	/ .2025
Columbian Carbon butyl stearate	lb.	.2525	/ .3425
Capryl alcohol	lb.	.195	/ .30
Caprylene	lb.	.10	/ .205
Dibenzyl sebacate	lb.	.91	/ 1.00
Dibutyl phthalate	lb.	.30	/ .395
Dibutyl sebacate CP	lb.	.655	/ .745
Dicapryl phthalate	lb.	.27	/ .36
Dihexyl adipate	lb.	.40	/ .495
Dihexyl phthalate	lb.	.30	/ .395
Dihexyl sebacate	lb.	.64	/ .73
Diisodecyl phthalate	lb.	.29	/ .385
Diisooctyl adipate	lb.	.40	/ .495
Diisooctyl phthalate	lb.	.28	/ .375
Dioctyl adipate	lb.	.40	/ .495
Dioctyl phthalate	lb.	.28	/ .375
Dimethyl sebacate	lb.	1.28	/ 1.37
Dioctyl sebacate	lb.	.60	/ .69
Harchemex	lb.	.24	/ .245
Harflex 300	lb.	.58	/ .675
325	lb.	.4325	/ .52
500	lb.	.315	/ .41
Isooctyldecyl phthalate	lb.	.285	/ .38
Methyl ethyl ketone	lb.	.26	/ .365
Sebacic acid, CP	lb.	.77	/ .89
Purified	lb.	.69	/ .81
Conoco H-300	lb.	.08	/ .11
Darex DIBA	lb.	.4325	/ .4675
DIBM	lb.	.305	/ .34
DIBP	lb.	.30	/ .335
DIDA, DIOA	lb.	.40	/ .435
DIDP	lb.	.29	/ .325
DIOP, DOP	lb.	.285	/ .32
DOS	lb.	.60	/ .63
Dinopol 235	lb.	.335	/ .37
IDO	lb.	.285	/ .32
MOP	lb.	.29	/ .325
Dow Plasticizer No. 5	lb.	.315	/ .54
Resin 276-V2, -V9	lb.	.265	/ .325
Drapex 3.2	lb.	.40	/ .49
Drew DP-100, DP-200	lb.	.4175	/ .46
DP-250	lb.	.4275	/ .47
DP-316	lb.	.2925	/ .335
DP-317	lb.	.555	/ .5975
DP-520	lb.	.415	/ .4575
SC	lb.	.435	
Dutch Boy Plasticizer NL-A10 (DBP)	lb.	$0.30	/ $0.33
NL-A20 (DOP), NL-A30 (DIOP)	lb.	.305	/ .335
NL-C20 (DOS)	lb.	.61	/ .63
NL-F21	lb.	.395	/ .425
NL-F31	lb.	.44	/ .47
NL-F41	lb.	.48	/ .51
NL-A54	lb.	.295	/ .325
Eastman di(2 ethyl hexyl) adipate, P.E.	lb.	.40	/ .435
Di (2 ethyl hexyl) azelate	lb.	.455	/ .49
Di-(2 ethyl hexyl) phthalate	lb.	.28	/ .315
Di-(2 ethylhexyl) sebacate	lb.	.61	/ .645
Di(methoxy ethyl) phthalate	lb.	.425	/ .46
Diisobutyl adipate	lb.	.41	/ .445
Dibutyl phthalate	lb.	.30	/ .335
Diethyl phthalate	lb.	.275	/ .31
Diisobutyl phthalate	lb.	.29	/ .325
Dimethyl phthalate	lb.	.295	/ .33
Dinonyl phthalate	lb.	.28	/ .315
Plasticizer 84	lb.	.27	/ .305
Polymericplasticizer NP-10	lb.	.50	/ .53
Triacetin	lb.	.365	/ .40
Tributyrin	lb.	.69	
Elastex 10-P, 28-P	lb.	.28	/ .315
18-P	lb.	.285	/ .32
20-A, 60-A	lb.	.40	/ .435
40-P, 48-P	lb.	.27	/ .305
50-B	lb.	.265	/ .30
80-P	lb.	.275	/ .31
90-P	lb.	.29	/ .325
DCHP, cast solid	lb.	.58	/ .59
Granular	lb.	.595	/ .605
Ethox	lb.	.50	/ .525
Flexol 3GH	lb.	.44	/ .46
3G0	lb.	.53	/ .55
4G0	lb.	.325	/ .35
8N8	lb.	.355	/ .38
10-10, 10-A	lb.	.29	/ .315
77-G, 426	lb.	.27	/ .295
380	lb.	.305	/ .33
810	lb.	.285	/ .31
A-26	lb.	.40	/ .425
B-400	lb.	.25	/ .275
CC-55	lb.	.305	/ .33
DOP	lb.	.28	/ .305
R2H	lb.	.59	
TOF	lb.	.43	/ .455
Flexricin 66	lb.	.3275	
P-4	lb.	.30	
P-6	lb.	.37	
P-8	lb.	.32	
Good-Rite GP-233, -235, -236	lb.	.40	/ .435
GP-261	lb.	.285	/ .32
GP-265	lb.	.29	/ .325
GP-266	lb.	.295	/ .33
Harchem butyl stearate	lb.	.2525	/ .3425
Capryl alcohol	lb.	.195	/ .30
Caprylene	lb.	.10	/ .205
Dibenzyl sebacate	lb.	.92	/ 1.01
Dibutyl phthalate	lb.	.30	/ .395
Dibutyl sebacate	lb.	.68	/ .77
Dicapryl phthalate	lb.	.27	/ .36
Dihexyl adipate	lb.	.40	/ .495
Dihexyl phthalate	lb.	.30	/ .395
Dihexyl sebacate	lb.	.65	/ .74
Diisodecyl phthalate	lb.	.29	/ .385
Diisooctyl adipate	lb.	.40	/ .495
Diisooctyl phthalate	lb.	.28	/ .375
Dimethyl sebacate	lb.	1.30	/ 1.39
Dioctyl adipate	lb.	.40	/ .495
Dioctyl phthalate	lb.	.28	/ .375
Dioctyl sebacate	lb.	.60	/ .69
Harchemex	lb.	.24	/ .345
Harflex 300	lb.	.58	/ .675
325	lb.	.4325	/ .52
500	lb.	.315	/ .41
Isooctyldecyl phthalate	lb.	.285	/ .38
Methyl hexyl ketone	lb.	.26	/ .365
Sebacic acid, CP	lb.	.77	/ .80
Purified	lb.	.69	/ .81
Harshaw dibutyl phthalate	lb.	.325	/ .385
Kapsol	lb.	.33	/ .355
Kay-Fries diethyl phthalate	lb.	.275	/ .36
Dimethyl phthalate	lb.	.28	/ .365
Kessco flex BCL	lb.	.365	/ .375
BCO	lb.	.355	/ .365
BCP	lb.	.33	/ .36
BCS	lb.	.305	/ .315
BO	lb.	.26	/ .28
BS	lb.	.235	/ .26
DBT	lb.	.64	
DDA, DIOA, DOA	lb.	.40	/ .435
DOZ	lb.	.46	/ .50
MCO	lb.	.3225	/ .3525
MCP	lb.	.37	/ .40
MCS	lb.	.33	/ .34
ODA	lb.	.47	/ .50
TRA	lb.	.37	/ .40
KP-23	lb.	.315	/ .32
-90	lb.	.40	/ .435
-140	lb.	.46	/ .485
-201	lb.	.58	/ .59
-220, -260	lb.	.33	/ .365
-555	lb.	.595	/ .60
Kronisol	lb.	.33	/ .365
Kronitex AA, I, K-3, MX	lb.	.325	/ .36
Methox	lb.	.385	/ .41
Monoplex DBS	lb.	.64	/ .665
DCP	lb.	.2925	/ .32
DOS	lb.	.58	/ .605
S-38	lb.	.215	/ .24
S-70	lb.	.3925	/ .42

S-71	lb.	$0.45 /	$0.475
Monsanto dibutyl phthalate	lb.	.30 /	.335
Diethyl phthalate	lb.	.29 /	.325
Dimethyl phthalate	lb.	.295 /	.33
Diphenyl phthalate	lb.	.53 /	.55
DIDP	lb.	.29 /	.325
DOA, DIDA	lb.	.40 /	.435
DOP, DIOP	lb.	.28 /	.315
DNODA	lb.	.40 /	.435
HB-20	lb.	.15 /	.17
HB-40	lb.	.19 /	.22
Tricresyl phosphate	lb.	.325 /	.36
Triphenyl phosphate	lb.	.415 /	.435
Morflex P-50	lb.	.68 /	.71
Naugatuck decylbutyl phthalate	lb.	.27 /	.30
Dibutyl phthalate	lb.	.30 /	.33
Sebacate	lb.	.645 /	.67
Diisooctyl adipate, dioctyl adipate	lb.	.425 /	.455
Diisooctyl phthalate, dioctyl phthalate, isooctyl decyl phthalate	lb.	.305 /	.335
Dinonyl adipate	lb.	.445 /	.475
Dioctyl sebacate	lb.	.585 /	.61
Epoxy plasticizer	lb.	.335 /	.36
Tricresyl phosphate	lb.	.345 /	.375
Ohio-Apex butyl oleate	lb.	.255 /	.265
Stearate	lb.	.22 /	.255
Diallyl phthalate	lb.	.49 /	.525
Dibutyl phthalate	lb.	.30 /	.335
Di-Carbitol phthalate	lb.	.49 /	.495
Diisobutyl adipate	lb.	.41 /	.445
Diisodecyl phthalate	lb.	.29 /	.325
Dioctyl phthalate	lb.	.28 /	.315
D.I.O.P.	lb.	.28 /	.315
Tributyl phosphate	lb.	.50 /	.535
Ohopex Q-10	lb.	.28 /	.315
R-9	lb.	.3525 /	.3775
Paraplex S-B	lb.	.29 /	.3475
AL-111	lb.	.32 /	.3275
G-20	lb.	.76 /	.7675
G-25	lb.	.76 /	.77
G-40	lb.	.4825 /	.51
G-50	lb.	.39 /	.4175
G-53	lb.	.4325 /	.46
G-60, -61	lb.	.3325 /	.36
G-62	lb.	.3525 /	.38
RG-2	lb.	.41 /	.6575
RG-7	lb.	.33 /	.6575
RG-8	lb.	.505 /	.335
RG-10	lb.	.52 /	.5125
Pfizer acetyl tributyl citrate, tech.	lb.	.32	.5275
Acetyl triethyl citrate, tech.	lb.	.36 /	.57
Triethyl citrate	lb.	.4575 /	.58
Plasticizer 1	lb.	1.17 /	1.37
Plasticizer 120	lb.	.44 /	.49
Plastoflex #3	lb.	.52 /	.57
#520	lb.	.36 /	.435
DBE	lb.	.50 /	.55
MGB	lb.	.29 /	.37
VS	lb.	.3575 /	.3975
Plastolein 9050 DHZ	lb.	.521 /	.565
9055 DGP	lb.	.365 /	.41
9057 DIOZ	lb.	.455 /	.50
9058 DOZ	lb.	.455 /	.50
9078LT	lb.	.40 /	.445
9250 THFO	lb.	.3575 /	.4025
9404 TGP	lb.	.3725 /	.4175
9715 & 9720 Polymeric	lb.	.365 /	.41
Polycizer 162	lb.	.28 /	.435
332, 532, 632	lb.	.40 /	.555
562	lb.	.285 /	.44
662, 662-BPA	lb.	.29 /	.445
Polycon #7, 9, 10, 11	lb.	.305 /	.335
#30	lb.	.30 /	.33
#31	lb.	.27 /	.30
#40	lb.	.245 /	.275
PX-104	lb.	.30 /	.33
-108, -118, -120, -138	lb.	.305 /	.335
-114	lb.	.27 /	.30
-208, -220, -238	lb.	.425 /	.455
-404	lb.	.645 /	.67
-438	lb.	.585 /	.61
-800	lb.	.325 /	.35
-917	lb.	.33 /	.36
Pycal 40	lb.	.3875 /	.4375
60	lb.	.60 /	.6352
63	lb.	.80 /	.835
94	lb.	.3275 /	.3775
140	lb.	.35 /	.40
170	lb.	.275 /	.325
194	lb.	.2775 /	.3275
RC Plasticizers:			
B-17	lb.	.21 /	.245
BD-8	lb.	.38 /	.4125
BIDP	lb.	.27 /	.305
DIDA, DIOA, DOA, ODA	lb.	.40 /	.435
DIDP	lb.	.29 /	.325
DIOP, DOP	lb.	.28 /	.315
DIOS, DOS	lb.	.60 /	.63
O-16	lb.	.275 /	.3075
ODP	lb.	.285 /	.32
TG-8	lb.	.3125 /	.3425
TG-9	lb.	.41 /	.4425
Santicizer 1-H	lb.	.50 /	.51
3	lb.	.46 /	.47
8	lb.	.43 /	.44
9	lb.	.39 /	.42
140	lb.	.325 /	.36
141	lb.	.34 /	.37
160	lb.	.25 /	.28
213	lb.	.27	
214	lb.	.29	
601	lb.	.32	
602	lb.	.305	
B-16	lb.	.4875 /	.4975
E-15	lb.	$0.5075 /	$0.5375
M-17	lb.	.4275 /	.4575
Staflex AX	lb.	.43	
BR	lb.	.26 /	.29
CP	lb.	.28 /	.31
DBES, DOS	lb.	.61 /	.635
DIOA, ODA	lb.	.435 /	.465
DIOP, DOP, MP	lb.	.305 /	.335
DOZ	lb.	.48 /	.5075
IXA	lb.	.32 /	.35
KA	lb.	.36 /	.3875
KD	lb.	.44 /	.4675
Witciser #100	lb.	.26 /	.27
#101	lb.	.31 /	.32
#200	lb.	.195 /	.205
#201	lb.	.235 /	.245
#300	lb.	.30 /	.33
#312, 313	lb.	.305 /	.33
#412	lb.	.435 /	.465

Resins & Molding Compounds

Acrylic

Cadco cast rods	lb.	1.63 /	6.47
polished	lb.	1.89 /	7.22
tubes	lb.	1.39 /	5.12
Lucite injection molding powders:			
Colorless, transparent	lb.	.55	
Std. colors	lb.	.59 /	1.00
Stock colors	lb.	.59 /	.84
Granular Powders for compression & extrusion	lb.	.51 /	.75
Plexiglas molding powders:			
Colorless	lb.	.55 /	.80
Colors, stock	lb.	.59 /	.84
Custom	lb.	.59 /	1.00
Sheets, Types I-A & II			
Colorless	sq. ft.	.80 /	22.18
Colors	sq. ft.	.88 /	1.10
Type R, Colorless	sq. ft.	.60 /	12.64
Colors	sq. ft.	.69 /	1.07
Type RL, colorless	sq. ft.	1.27 /	1.50
Colors	sq. ft.	1.52 /	1.80
Polycast 1	sq. ft.	.80 /	2.40

Alkyd

Plaskon foundry resin 580-11L	lb.	.245 /	.275
Molding Compound,			
Type 411	lb.	.43 /	.60
Type 413, 417	lb.	.57 /	.74
Type 420 black	lb.	.44 /	.695
Type 422 colored	lb.	.51 /	.695
Mottle	lb.	.52 /	.705
Natural	lb.	.49 /	.60
Type 430	lb.	.34 /	.50

Cellulosic

Cellulose acetate:			
Celanese cast & extruded film:			
Standard length rolls, clear	lb.	.67 /	1.03
Colors	lb.	.93 /	1.19
Matte finish	lb.	1.48 /	1.82
Stock & cut sheets, clear	M. sq. in.	.033 /	.11
Colors	M. sq. in.	.044 /	.136
Matte finish	M. sq. in.	.089 /	.165
Celanese cast sheeting:			
Standard length rolls, clear	M. sq. in.	.129 /	1.47
Matte finish	M. sq. in.	.16 /	.657
Tinted	M. sq. in.	.243 /	.722
Stock & cut sheets, clear	M. sq. in.	.145 /	1.55
Matte finish	M. sq. in.	.183 /	.767
Tinted	M. sq. in.	.259 /	.862
Lumarith molding compounds:			
Group I	lb.	.52 /	.61
Group II	lb.	.48 /	.57
Group III	lb.	.41 /	.50
Non-stock extruded rolls, clear	M. sq. in.	.14 /	1.34
Colors	M. sq. in.	.18 /	1.65
Extruded sheets, clear	M. sq. in.	.17 /	2.34
Colors	M. sq. in.	.19 /	2.15
Stock extruded rolls, clear	M. sq. in.	.14 /	.97
Colors	M. sq. in.	.18 /	1.00
Extruded sheets, clear	M. sq. in.	.17 /	1.84
Colors	M. sq. in.	.19 /	1.84
Poly-Cell Group I	lb.	.50 /	.59
Group II	lb.	.46 /	.55
Group III	lb.	.38 /	.48
Group IV	lb.	.57 /	.66
Group V	lb.	.52 /	.61
Tenite Acetate, Group 1	lb.	.50 /	.59
Group 2	lb.	.46 /	.55
Group 3	lb.	.41 /	.51
Group 4	lb.	.38 /	.49
Group 5	lb.	.65 /	.75
Cellulose acetate butyrate:			
Tenite butyrate	lb.	.62 /	.71
A pearls	lb.	.72 /	.81
Blacks, reprocessed	lb.	.50 /	.58
Cellulose propionate:			
Forticel	lb.	.63 /	.71
Essence pearls	lb.	.73 /	.81
Reprocessed blacks	lb.	.41 /	.48
Ethyl cellulose:			
Dyeform 720, 721	lb.	$1.29 /	$1.52
Ethocel PG	lb.	.72 /	.80
Bulk, reg.	lb.	.66 /	.81
Std., 7 cps.	lb.	.71 /	.86
Hercocel E	lb.	.72 /	.88

Epoxy

Araldite 502, 506, 6005, 6010	lb.	.77 /	.86
6020, 6030, 6040	lb.	.80 /	.86
6060	lb.	.75 /	.83
6071, 6075	lb.	.615 /	.6225
6084	lb.	.595 /	.6025
6097	lb.	.6025 /	.6125
6099	lb.	.69 /	.6975
Bakelite ERL Series	lb.	.80 /	.995
Emerson & Cuming:			
Eccobild 121	lb.	1.20 /	1.60
127	lb.	3.50 /	3.75
420	lb.	.84 /	.99
430	lb.	.90 /	1.15
470	lb.	2.65 /	3.25
490	lb.	1.50 /	1.70
Epi-Rez 504, 507, 510, 515	lb.	.80 /	.86
520	lb.	.615 /	.6225
522	lb.	.605 /	.6125
Epocast 2, 3, 5	lb.	1.33 /	1.77
4-B-2, 4-B, 4-C, 4-C-T, 4-D, Paste	lb.	1.09 /	1.15
Epon 562	lb.	1.09 /	1.12
815, 820	lb.	.65 /	.71
828	lb.	.62 /	.685
834	lb.	.75 /	.785
834-X-90	lb.	.685 /	.715
864	lb.	.885 /	.92
864-C-75	lb.	.6525 /	.6625
1001	lb.	.575 /	.5825
1001-A-80	lb.	.515 /	.525
1001-BT-70	lb.	.4375 /	.4675
1001-CX-75	lb.	.465 /	.495
1001-T-75	lb.	.47 /	.48
1002, 1007	lb.	.555 /	.5625
1004	lb.	.50 /	.535
1007-CT-55	lb.	.395 /	.405
1009	lb.	.63 /	.6375
Furane CN-502	lb.	1.33 /	1.77
Jet-Kote (with cat.)	gal.	7.50 /	10.00
Maraset 602, 610, 610V, 612B, 613, 648	lb.	1.20 /	1.70
604A, 607	lb.	1.17 /	1.40
608	lb.	1.17 /	1.65
614A, 631A, 618A, 640	lb.	1.32 /	1.77
645	lb.	1.15 /	1.70
Reichhold Polytool Resins:			
6125, 6130, 6140	lb.	.80 /	1.58
Rezolin L-900, 900W	lb.	1.00 /	1.94
902	lb.	2.41	
906	lb.	1.19 /	1.80
910	lb.	1.086 /	2.34
916, 916A	lb.	1.19 /	1.71
940	lb.	1.285 /	2.29
930A	lb.	1.29 /	1.90
933A	lb.	1.29 /	1.80
953A	lb.	1.665 /	1.99
LT-904	lb.	.996 /	1.83
914	lb.	1.073 /	2.18
932	lb.	1.05 /	1.79
Sealcast 501	lb.	1.55 /	1.65
502, 504, 505	lb.	1.75 /	1.85
503	lb.	1.65 /	1.75
Sealfoam 601	lb.	2.90 /	3.15
602	lb.	3.00 /	3.25
603	lb.	2.50 /	2.75
604	lb.	2.85 /	3.10
Toolplastik packages:			
L-900, L-930	lb.	1.59 /	2.29
L-902	lb.	1.69 /	1.84
L-904	lb.	1.54 /	2.19
L-910	lb.	1.94 /	2.34
L-914	lb.	1.83 /	2.19
L-931	lb.	1.75 /	1.99
L-940	lb.	2.05 /	2.29

Fluorocarbon

Bakelite FGBB-33789, FGEB-34790, FXMA-50590, FXMB-50344	lb.	9.00 /	10.00
FGEB-32788, FXMB-50090	lb.	12.00 /	14.00
FYTD	lb.	11.00 /	13.00
FYTH, FYTS	lb.	8.50 /	9.50
Kel-F Grade 270, 300			
High density	lb.	6.50 /	9.00
Low density	lb.	6.00 /	8.50
Grade 300—P-25			
High density	lb.	7.50 /	10.00
Low density	lb.	7.00 /	9.50
Grade 500-F, 500-R			
High density	lb.	7.00 /	9.50
Low density	lb.	6.50 /	9.00
Polyfluoron, high density pellets, grades HT, MT, LT	lb.	6.50 /	9.00

colored	lb.	$7.00 /	$9.50
Low density pellets, Clear grades HT, MT, LT	lb.	6.00 /	8.50
colored	lb.	6.50 /	9.00
Liquid dispersions, 40% HT, MT, LT	lb.	4.20 /	4.40
35% HT, MT, LT	lb.	3.20 /	3.85
30% HT, MT, LT	lb.	3.15 /	3.30
25% HT, MT, LT	lb.	2.65 /	2.75
Mikron-atomized powder, clear dispersion grades HT, MT, LT	lb.	8.00 /	10.50
colored	lb.	8.50 /	11.00
Teflon 1	lb.	4.50 /	5.55
5	lb.	4.75 /	5.80
6	lb.	7.45 /	8.00
30 aqueous dispersion	lb.	5.60 /	6.85

Melamines

Fiberite 2015 (black & pastels)	lb.	.57 /	.62
Pelleted	lb.	.61 /	.66
Cymel 402	lb.	.51 /	.53
404R, 404T	lb.	.85 /	.95
405, 428, 430	lb.	.38 /	.40
480	lb.	.265 /	.315
1077, 1079	lb.	.47 /	.77
Ungranulated	lb.	.45 /	.75
1500	lb.	.42 /	.55
1502	lb.	.50 /	.63
3020	lb.	.57 /	.72
3135	lb.	.85 /	1.05
3136	lb.	1.05 /	1.15
P-592	lb.	.65 /	.75
Plaskon	lb.	.44 /	.75

Phenolic

91-LD	lb.	1.50 /	2.50
Admirex PL-50	lb.	.215	
UP-11	lb.	.2325	
Bakelite general purpose	lb.	.187 /	.3525
BMG-5000	lb.	.19 /	.30
Colors	lb.	.2375/	.435
Chem. resist	lb.	.23 /	.40
Electric Insul	lb.	.2725/	.4125
Heat resist	lb.	.19 /	.35
Impact resist	lb.	.24 /	.40
Barrett foundry resins, liquid	lb.	.2125/	.2425
Powdered	lb.	.27 /	.355
Insulation resins	lb.	.15 /	.175
Molding resin 313, 314, 317	lb.	.27 /	.285
316	lb.	.295 /	.31
1502, -3, -4, -5, R-110R	lb.	.25 /	.265
R-114	lb.	.285 /	.30
Corfoam 107, 114	lb.	.55 /	.82
Cyacor 151	lb.	.215 /	.235
191	lb.	.13 /	.16
Durez, Brake lining resins:			
8054, powdered	lb.	.35 /	.39
13848, powdered	lb.	.29 /	.33
14000, powdered	lb.	.32 /	.36
Foundry resins:			
18115, liquid	lb.	.22 /	.23
18123, 18250, powdered	lb.	.265 /	.275
Resins, rubber compounding:			
12603, lump	lb.	.245 /	.255
12687, powdered	lb.	.36 /	.40
13355, powdered	lb.	.275 /	.315
Resins, wood flour bonding:			
12763, 18520, powdered	lb.	.30 /	.31
Durite GP	lb.	.195 /	.24
HR	lb.	.191 /	.3025
IM	lb.	.24 /	.415
SG	lb.	.195 /	.3575
Dyform	lb.	1.10 /	1.35
Fiberite 1078	lb.	.43 /	.47
1153	lb.	.47 /	.50
1164	lb.	.475 /	.51
1270, 1330, 1332	lb.	.395 /	.43
1271, 1347, 1389	lb.	.40 /	.44
1346	lb.	.42 /	.4925
2015	lb.	.57 /	.63
4030	lb.	.95 /	.99
4031	lb.	.635 /	.65
4035	lb.	.60 /	.82
6100	lb.	1.10 /	1.12
FM-926	lb.	.44 /	.455
-927	lb.	.42 /	.435
-1132, -3510, -3515	lb.	.40 /	.43
-1914, -1996	lb.	.39 /	.405
-10365, -11678	lb.	.68 /	.715
-11547, -17610	lb.	1.08 /	1.10
-14111	lb.	.43 /	.445
-17067	lb.	.85 /	.865
X409	lb.	.285 /	.325
G-E molding powders:			
12401	lb.	.31 /	.41
13408, 12486	lb.	.205 /	.215
12410, 12420	lb.	1.50 /	1.60
12432	lb.	.405 /	.505
12433	lb.	.565 /	.665
12435	lb.	.25 /	.35
12439-A, 12466	lb.	.265 /	.365
12444	lb.	.435 /	.535
12463	lb.	.415 /	.515
12467	lb.	.51 /	.61
12487, 12489, 12884, 12887	lb.	.365 /	.465
12491, 12493, 12853, 12900, 12901, 12902, 12920, 12921	lb.	.21 /	.31
12494	lb.	.385 /	.485
12808	lb.	.50 /	.60
12809	lb.	.66 /	.76
12871-A	lb.	$0.22 /	$0.32
12824	lb.	.505 /	.605
12841, 12906	lb.	.255 /	.355
Loven LHR-401, -403	lb.	.225 /	.23
-407, -409	lb.	.60 /	1.00
-408	lb.	.25 /	.255
LI-201	lb.	.39 /	.40
-207	lb.	.475 /	.48
-209	lb.	.60 /	1.00
-212	lb.	.425 /	.43
LM-110, -119	lb.	.19 /	.195
-101	lb.	.24 /	.245
-116	lb.	.255 /	.26
-117	lb.	.225 /	.23
-118	lb.	.1975/	.2025
LMI-301	lb.	.2525/	.2575
-303	lb.	.345 /	.35
-304	lb.	.60 /	1.00
-307	lb.	.3075/	.3125
LMM-801, -803	lb.	.2125/	.2175
-804, -811	lb.	.245 /	.25
-807	lb.	.215 /	.22
Marblette 76, 77	lb.	.50 /	.60
Foam resin 1076	lb.	.50 /	.60
Plenco foundry resins	lb.	.27 /	.35
Molding empds. gen. purpose	lb.	.185 /	.235
Heat resist	lb.	.19 /	.24
Improved impact	lb.	.225 /	.28
Min. bleed	lb.	.185 /	.195
Radio & TV	lb.	.20 /	.215
Stock	lb.	.205 /	.34
Reichhold Foundry Resins:			
Corciment	lb.	.135 /	.17
Corovit	lb.	.275 /	.31
Foundrez, core binder liquids	lb.	.21 /	.25
Shell molding liquids	lb.	.195 /	.245
Powders	lb.	.2675/	.3025
Plyophen molding cmpds.:			
5440, 5596, 5655, 5660	lb.	.30 /	.325
5510, 5510-C	lb.	.34 /	.365
5657, 5658, 5661	lb.	.315 /	.34
Reilly general purpose	lb.	.195 /	.20
Heat & impact resist	lb.	.20 /	.205
Resinox molding compounds:			
Gen. purpose & heat resist	lb.	.205 /	.215
Impact	lb.	.255 /	.3225
Low elec. loss	lb.	.31 /	.365
Special grade	lb.	.215 /	.255
Rogers phenolic molding compounds:			
RX 425	lb.	.29 /	.295
Special colors	lb.	.34 /	.405
RX 428	lb.	.355 /	.36
Special colors	lb.	.42 /	.465
RX 429	lb.	.365 /	.37
Special colors	lb.	.395 /	.48
RX 431	lb.	.4125/	.4175
Special colors	lb.	.455 /	.55
RX 438	lb.	.4675/	.4725
RX 441, 455	lb.	.32 /	.325
RX 442	lb.	.3475/	.3525
RX 447	lb.	.5025/	.51
RX 448	lb.	.355 /	.36
RX 458	lb.	.38 /	.385
RX 469	lb.	.365 /	.37
RX 470, 480	lb.	.40 /	.405
RX 478, 488	lb.	.415 /	.43
RX 525, 545	lb.	.29 /	.295
RX 530	lb.	.4125/	.417
Special colors	lb.	.42 /	.475
RX 547	lb.	.37 /	.375
RX 625	lb.	.395 /	.40
RX 628	lb.	.455 /	.46
Schenectady shell mold resins	lb.	.26 /	.28
Synvar molding compounds, PM series	lb.	.205 /	.2625
Synvaren 640	lb.	.30 /	.335
920	lb.	.21 /	.245
935	lb.	.195 /	.23
9203, 9203A	lb.	.173 /	.208
Synvaren liquid industrial resins:			
675	lb.	.29 /	.325
920	lb.	.21 /	.245
CP-66	lb.	.19 /	.225
PBL-2	lb.	.33 /	.365
PBL-218S	lb.	.27 /	.305
Synvarite GW-1000	lb.	.34 /	.36
GW-1080, PBL-F, PBL-718	lb.	.37 /	.39
GW-2400	lb.	.375 /	.395
PBL-100	lb.	.31 /	.33
PBL-108FF	lb.	.38 /	.40
PBL-210, PBL-3301	lb.	.36 /	.38
PBL-410	lb.	.33 /	.35
PBL-3311	lb.	.35 /	.37
PNL-12HL/11, PNL-156HL/24	lb.	.3025/	.3225
PNL-159H, PNL-169H	lb.	.29 /	.31
PNL-169PD, PNL-179PD	lb.	.28 /	.30
PNL-355PD	lb.	.315 /	.335
PNL-1279HL	lb.	.2875/	.3075
PT	lb.	.32 /	.34
Toolplastik No. 8000	lb.	.48 /	.72

Polyamide

Catalin Nylons:			
Natural	lb.	1.18 /	1.45
Black and white	lb.	1.28 /	1.45
Colors, std.	lb.	1.37 /	1.65
Special	lb.	1.37 /	1.80
Fiberfil Nylon G, natural	lb.	1.70 /	1.90
Standard colors	lb.	1.80 /	2.20
Nylatron G5	lb.	1.28	
Plaskon 8200, 8201 natural	lb.	1.33 /	1.50
Black	lb.	$1.53 /	$1.70
White	lb.	1.43 /	1.60
Other colors	lb.	1.63 /	1.80
Spencer Nylon 401, 402	lb.	1.18 /	1.66
600, 603	lb.	1.18 /	1.65
601	lb.	1.28 /	1.45
602	lb.	1.33 /	1.80
604, 606	lb.	1.28 /	1.75
Versamid 115	lb.	.64 /	.82
Zytel molding powder	lb.	1.435 /	1.60
Zytel, natural color	lb.	1.18 /	1.35
Blacks and whites	lb.	1.43 /	1.80
Colors	lb.	1.63 /	2.05

Polyesters

Acme 1-501	lb.	.82 /	.93
1-501A	lb.	.87 /	.98
1-503	lb.	2.75 /	3.50
1-510	lb.	.89 /	1.00
Atlac 363E-02Z, -12Z	lb.	.66 /	.69
-32Z	lb.	.68 /	.71
382E	lb.	.57 /	.60
FP	lb.	.66 /	.69
Bakelite Polyester resins	lb.	.35 /	.75
Diall 50-01	lb.	2.45	
50-51	lb.	3.25 /	3.50
50-52	lb.	3.50	
51-01	lb.	.87 /	1.15
52-01	lb.	2.25 /	2.50
52-20-30	lb.	1.50	
Diall 50-01, 50-51, 50-52	lb.	2.75 /	3.50
51-01	lb.	.87 /	98
52-01	lb.	1.95 /	2.50
52-20-30	lb.	1.30 /	1.50
Fibercore 1000, 2000	lb.	.50 /	.65
3000	lb.	.55 /	.70
G-E polyesters			
AR 401	lb.	.35 /	.365
AR 403, 480	lb.	.34 /	.355
AR 403 LS, 480 LS	lb.	.355 /	.37
AR 493	lb.	.40 /	.415
AR 499	lb.	.435 /	.45
AR 501	lb.	.455 /	.47
Hetron 33	lb.	.39 /	.405
32A	lb.	.435 /	.45
92	lb.	.43 /	.445
93LS	lb.	.485 /	.50
IC-312, -400, -514, -548, -625, -730, -800	lb.	.35 /	.385
-312-2	lb.	.365 /	.38
-336, -382, -706	lb.	.37 /	.385
-401	lb.	.44 /	.455
-420	lb.	.355 /	.37
-433	lb.	.38 /	.395
-636, -670	lb.	.48 /	.495
-638, -689	lb.	.55 /	.565
-670-2	lb.	.50 /	.515
-671	lb.	.405 /	.42
Filled resins	lb.	.255 /	.54
Laminac 4101, 4105, 4106, 4110, 4116	lb.	.34 /	.355
4102, 4120	lb.	.39 /	.405
4103, 4123, 4128	lb.	.35 /	.365
4107, 4109	lb.	.51 /	.525
4111, 4129	lb.	.46 /	.475
4119	lb.	.41 /	.425
4192	lb.	.365 /	.38
4202	lb.	.56 /	.575
Marco resins:			
CEL-101, Marcothix 1, 3	lb.	.51 /	.525
Marcothix, 5, 7, 8	lb.	.47 /	.485
Marcothix 9, MR-31C, 28H, 41-R	lb.	.37 /	.385
Marcothix 10, MR-28C, -28V, -31V, -37C, -37CX	lb.	.34 /	.355
MR-28CS	lb.	.36 /	.375
MR-28R, -42R	lb.	.35 /	.365
MR-28RL, -37RL	lb.	.365 /	.38
MR-30C	lb.	.45 /	.465
MR-33C	lb.	.54 /	.555
MR-40R	lb.	.39 /	.405
MR-60C	lb.	.42 /	.435
MR-61H	lb.	.43 /	.445
Mylar, rolls, types A & C	lb.	2.50 /	4.80
Type D	lb.	3.00 /	3.30
Sheets, type A	M. sq. in.	.09 /	1.11
Type C	M. sq. in.	.09 /	.15
Type D	M. sq. in.	.53 /	1.34
Plaskon 911, 920	lb.	.55 /	.665
941, 942, 951, 9411	lb.	.35 /	.465
943	lb.	.41 /	.525
9404	lb.	.365 /	.48
9406	lb.	.355 /	.465
9500, 9510, 9511	lb.	.35 /	.465
9600	lb.	.44 /	.555
Pleogen 1000, 1001, 1002, 1006, 1007, 1100, 1810	lb.	.34 /	.355
1150, 1501	lb.	.365 /	.375
1201	lb.	.50 /	.51
1300, 1301	lb.	.35 /	.36
1300LS, 1700, 1813	lb.	.37 /	.38
1402	lb.	.44 /	.45
1406	lb.	.46 /	.47
1602	lb.	.35 /	.365
1800, 1802	lb.	.45 /	.46
Polycast 2	sq. ft.	1.89 /	5.18
3	sq. ft.	1.08 /	18.00
6	sq. ft.	.66 /	3.10
7	sq. ft.	.72 /	7.18
CR-39	sq. ft.	1.25 /	20.00
Polylite 8000, 8001, 8005, 8007, 8017, 8037, 8173, 8200	lb.	.34 /	.355
8006, 8008, 8009, 8039, 8166	lb.	.35 /	.365
8016, 8100	lb.	.365 /	.38
8050	lb.	.41 /	.425

8061, 8065	lb.	$0.44	$0.455
8120	lb.	.48	.495
8150	lb.	.45	.465
8170, 8237	lb.	.38	.395
8180, 8181	lb.	.36	.375
8400	lb.	.56	.575
Pre-Imp.	lb.	.68	.85
Thermaflow 100, 200, 300	lb.	.48	.82
400, 500	lb.	.52	.87
1,000, 2,300	lb.	.34	.55
2,400	lb.	.36	.58
Vibrin 114, 117, 152, 154	lb.	.34	
115A	lb.	.38	
121	lb.	.46	
135	lb.	3.00	
142	lb.	.50	
151	lb.	.35	
152LS-4	lb.	.355	
153	lb.	.40	
X-1633-A	lb.	.49	
X-1636-W	lb.	.585	

Polyethylene

A-C No. 6, 617	lb.	.30	.37
No. 6A, 7, 617A	lb.	.35	.42
No. 615, G-201	lb.	.38	.45
No. 629	lb.	.40	.47
No. 729	lb.	.45	.52
Alathons, Group I	lb.	.35	.43
Group II	lb.	.37	.515
Group III	lb.	.375	.42
Bakelite DE Series	lb.	.43	.725
DVGT	lb.	.54	.69
DYLT, DYNF, DYNH	lb.	.41	.59
DYNJ	lb.	.44	.62
DYNK	lb.	.45	.63
Catalin, low density, nat.	lb.	.35	.46
Black	lb.	.37	.54
High density, nat.	lb.	.43	.47
Black	lb.	.45	.495
Colors	lb.	.49	1.06
Fortiflex A-20, 70, 250, 500, nat.	lb.	.43	.49
colors	lb.	.49	1.06
black	lb.	.455	.495
Grex, nat.	lb.	.43	.47
gen. purpose black	lb.	.455	.495
colors and special purpose black	lb.	.49	1.06
Hi-fax, nat.	lb.	.43	.47
colors	lb.	.49	1.06
General purpose blacks	lb.	.455	.495
pipe blacks	lb.	.475	.515
electrical grade	lb.	.49	.57
monofilament	lb.	.42	.47
Marlex, types 2, 9, 15, 35, 50:			
Black, general purpose	lb.	.455	.495
High dispersion and plain	lb.	.49	1.06
Natural	lb.	.43	.47
With special antioxidants	lb.	.45	.49
Petrothene 100, 101, 200, 202, 203, 205, 206, 207, 208, 301	lb.	.35	.45
300, 300-200	lb.	.465	.565
300-6	lb.	.425	.525
301, electrical grade	lb.	.41	.51
301-6	lb.	.37	.47
301-200, 301-202, 302-506, 560	lb.	.375	.48
302-6	lb.	.39	.49
Poly-Eth 1005, 1007, 1085, 1099, 1105, 1407, 1408.5, 2007, 2205, 2215, 2235, 2206, 2226, 2236, 2256, 2405, 2425, 2976, 2477,	lb.	.35/	.49
3215	lb.	.37	.51
3226, 3405	lb.	.375	.515
3495	lb.	.50	.64
Hi-D 1504, 2504, 3504	lb.	.45	.56
Reynolon 1000, P series	lb.	.60	.80
Rulan 2	lb.	.48	.52
Tenite Group 1	lb.	.41	.45
Group 2	lb.	.43	.47
Group 3	lb.	.46	.50
Group 4	lb.	.39	.43
Group 5, 6	lb.	.50	.72
Group 7	lb.	.60	.82
Group 8	lb.	.70	.92

Polypropylene

Moplen, natural	lb.	.49	.55
Standard colors	lb.	.58	.85
Pro-Fax, natural	lb.	.49	.72
Standard colors	lb.	.58	1.18

Silicone

Bakelite GMGA-5001, -5002	lb.	2.75	3.10
5003	lb.	4.00	4.35
5004	lb.	5.40	5.75
Dow Corning 301	lb.	3.60	4.00
2103	lb.	1.55	1.65
2105, 2106	lb.	1.59	1.70

Styrenes

Ampacet, crystal	lb.	.315	.335
Colors, std.	lb.	.345	.365
Special	lb.	.345	.75
Pearl	lb.	.41	.75
Phosphorescent	lb.	.695	1.00
Tinsel	lb.	.41	.67
Confetti	lb.	.51	.70
Bakelite BMC series, nat.	lb.	.45	.685
Colors	lb.	$0.50	$0.735
BMS, SMD series, crystal	lb.	.295	.31
Colors, std.	lb.	.335	.35
Special	lb.	.335	.52
RMD series, nat.	lb.	.45	.685
Colors	lb.	.50	.735
TGD series	lb.	.33	.35
Colors, std.	lb.	.36	.38
Special	lb.	.36	1.00
TMD series	lb.	.33	.40
Colors, std.	lb.	.36	.43
Special	lb.	.36	1.00
Catalin, extra high impact, Natural & black	lb.	.385	.415
Colors, std.	lb.	.425	.445
Special	lb.	.425	1.00
High impact, natural & black	lb.	.32	.34
Colors, std.	lb.	.345	.385
Special	lb.	.345	1.00
General purpose, crystal	lb.	.2425/	.2575
Colors, std.	lb.	.2725/	.2925
Special	lb.	.2725/	1.00
Medium impact, colors, std.	lb.	.34	.365
Special	lb.	.34	1.00
Utility black, gen. purpose	lb.	.1975	
Medium impact	lb.	.215	
High impact	lb.	.26	
Cycolac compounds: Natural powders	lb.	.53	.65
Natural & std. color pellets	lb.	.58	.62
Cymac 201	lb.	.405	.435
400	lb.	.2425/	.2575
Darex Copolymer 3	lb.	.47	.67
43G	lb.	.39	.58
X34	lb.	.42	.61
Latices 3L	lb.	.415	.56
610L	lb.	.30	.46
3020	lb.	.32	.47
Dow Latex: styrene/ butadiene	lb.	.295	.57
Resins PS-2 & 3	lb.	.25	.35
butadiene	lb.	.30	.46
Dylite, expandable beads	lb.	.50	.60
Fiberfil Styrene G, natural	lb.	.55	1.00
Standard colors	lb.	.65	2.00
Koppers, Fibertuff	lb.	.55	1.505
MC-185 series	lb.	.33	.355
-300 series	lb.	.33	1.005
-400 series	lb.	.355	1.005
Regular, crystal	lb.	.295	.315
Colors, std.	lb.	.335	.355
Special	lb.	.335	1.005
Pearl	lb.	.41	1.005
Phosphorescent	lb.	.695	2.005
Kralastic, std. colors	lb.	.50	1.10
Lustrex Hi-Flows 55, 66, 77, and Hi-Heat 99 crystals	lb.	.26	.275
LHA standard colors	lb.	.34	.365
special colors	lb.	.34	1.00
Hi-Test 88 & 89	lb.		
Natural & 844 black	lb.	.32	.34
standard colors	lb.	.345	.385
special colors	lb.	.345	1.00
Marbon resins	lb.	.39	.46
Plio-Tuf C75, R100	lb.	.37	.45
G85	lb.	.52	.59
P100, std. colors	lb.	.41	.45
Polycast 4	sq. ft.	2.56	11.07
Styron 475, natural	lb.	.33	.35
Colors, std.	lb.	.36	.38
Special	lb.	.36	1.00
Sheets, std.	lb.	.55	.60
Special	lb.	.55	.62
480, natural black	lb.	.38	.40
Colors, std.	lb.	.41	.43
Special	lb.	.41	1.00
647, crystal	lb.	.305	.32
Colors, special	lb.	.345	1.34
66, 688, crystal	lb.	.295	.31
Colors, std.	lb.	.335	.35
Special	lb.	.335	1.00
700, crystal	lb.	.295	.31
Colors, std.	lb.	.335	.35
Special	lb.	.335	1.00
777 colors, std.	lb.	.355	.375
Special	lb.	.355	1.00

Urea

Admirex Foundry Resins, SP-30	lb.	.27	
UP-50	lb.	.105	
Beetle C-498 Brown	lb.	.30	
No fines granulation	lb.	.22	.32
T-298 Black	lb.	.20	.30
MUP series, powder	lb.	.31	.50
Special colors	lb.	.31	.60
Granules	lb.	.34	.53
Special colors	lb.	.34	.63
Foundrez core binder	lb.	.105	.14
Plaskon molding cmpds.: Black & Brown	lb.	.1875/	.30
Other colors	lb.	.30	.62
Foundry resins, liquid	lb.	.10	.13
Powdered	lb.	.2325/	.2525
Sylplast molding cmpds., granules	lb.	.33	
Powder	lb.	.30	

Vinyls

Bakelite QG-5909	lb.	.35	.585
QG-5921	lb.	.41	.645
5924	lb.	$0.43	$0.665
QYNA, QYSM, QYSQ	lb.	.27	.47
QYNV	lb.	.30	.50
QYSJ	lb.	.28	.48
VG-1914, 1918	lb.	.37	.056
1985	lb.	.35	.585
5507	lb.	.31	.545
5544	lb.	.405	.64
5911	lb.	.315	.55
5980	lb.	.32	.555
7734	lb.	.28	.515
9031	lb.	.265	.50
9530	lb.	.275	.51
9960, 9970, 9980	lb.	.335	.57
VAGH	lb.	.55	.75
VMCH	lb.	.41	.61
VYDR, VYNW	lb.	.27	.47
VYHH	lb.	.32	.52
VYLF	lb.	.36	.56
VYNS	lb.	.44	.64
VYNV	lb.	.32	.52
Blacar No. BW-60	lb.	.315	.385
NEMA colors	lb.	.355	.425
No. BW-80	lb.	.405	.455
NEMA colors	lb.	.445	.495
No. PC white, ivory, black	lb.	.285	.335
Other colors	lb.	.325	.375
Celanese Chemulsions 100, 101, 102	lb.	.18	.275
201, 202	lb.	.20	.295
Darex Everplex A (wet wt.)	lb.	.21	.39
B (wet wt.)	lb.	.22	.40
G (wet wt.)	lb.	.21	.39
Copolymer Y (wet wt.)	lb.	.245	.28
PVA Emulsions (wet wt.)	lb.	.19	.355
Diamond PVC-45, -50	lb.	.27	.33
Dow PVC-100, -111	lb.	.38	.57
Du Pont Elvanol 50-42	lb.	.83	
51-05, 71-30	lb.	.64	
52-22	lb.	.75	
72-60	lb.	.57	
Escambia Pearls, 2185, 2200, 2225, 2250	lb.	.27	.47
Exon 402-A, 500, 666, 905, 911, 914, 921, 924, 931, 965	lb.	.25	.43
425, 450	lb.	.32	.50
461	lb.	9.75	
468	lb.	.30	.48
470	lb.	.48	.66
471	lb.	.45	.63
487	lb.	.275	.455
650, 654	lb.	.28	.46
Formvar	lb.	.865	1.03
Gelva emulsions	lb.	.19	.205
Granules	lb.	.4175/	.617
Geon 101, 101EP, 103EP, 118, 202	lb.	.25	.42
121	lb.	.28	.46
126	lb.	.27	.45
400X17, 404HI	lb.	.37	.55
400X110	lb.	.41	.59
421	lb.	.44	.62
427	lb.	.32	.50
428	lb.	.30	.48
435	lb.	.275	.455
Krene, film	lb.	.505	.655
Sheeting	lb.	.49	.645
Marvinols: NF-1005	lb.	.34	.625
NF-1055, 3520	lb.	.275	.565
NF-3020	lb.	.41	.645
NF-3025	lb.	.38	.6625
NF-3040	lb.	.3375/	.625
NF-3045, 3050	lb.	.37	.60
NF-3055	lb.	.285	.575
NF-3060	lb.	.29	.575
NF-3065	lb.	.30	.58
NF-3070, 3075, 3080	lb.	.265	.505
NF-3085, 3090, 3095	lb.	.29	.525
NF-3505, 3515	lb.	.36	.595
NF-3510	lb.	.34	.575
NF-4005	lb.	.44	.675
NF-4010, 4015, 4020	lb.	.42	.705
NF-5015, 5020	lb.	.40	.655
NF-5025	lb.	.33	.585
NF-5030	lb.	.29	.545
NR-6015	lb.	.39	.685
NR-6020	lb.	.39	.675
NR-7002, 7045, 7060	lb.	.50	.73
VR-10	lb.	.28	.47
VR-12, -20, -21, -22, -24, -30	lb.	.27	.46
VR-50	lb.	.30	.49
Opalon 410	lb.	.30	.50
505, 510	lb.	.32	.52
1006	lb.	.315	.55
1018	lb.	.28	.515
1028, 1038, 72217, 75167, 75223	lb.	.33	.565
1308	lb.	.27	.505
1406	lb.	.415	.465
1706	lb.	.385	.62
71329	lb.	.275	.51
72285	lb.	.3375/	.5725
75179	lb.	.335	.57
78096	lb.	.395	.63
78197	lb.	.32	.55
78207	lb.	.29	.525
78210, 78211	lb.	.335	.57
78216	lb.	.31	.545
78343	lb.	.285	.52
Plastiflex, std.	lb.	.90	1.10
Novelty	lb.	1.15	1.50
Pliovic AO (dispersion)	lb.	.30	.32
DB80V, DB90V, EDB90V	lb.	.27	.29
Latex 300	lb.	.30	.35

Reynolon PVA/4-6, roll stock 1 mill	lb.	$1.85	$3.25
1½, 2, 3, 4, 5, 6, 8 mill	lb.	1.60	3.00
Satinflex	lb.	1.15	1.50
Vygen 85	lb.	.43	.80
105, 161	lb.	.43	.93
110	lb.	.43	1.08
120	lb.	.43	1.18
Vinac RP-250	lb.	.55	1.03

Vinyldine

Dow Latex 744-B	lb.	.26	.42
Resin 565	lb.	.39	.525
Saran formulation 115, black, nat	lb.	.39	.52
Colors	lb.	.44	.69
720 nat	lb.	.41	.54
Colors	lb.	.46	.71
747 nat	lb.	.395	.525
761 nat	lb.	.39	.52
Colors	lb.	.44	.69
820 nat	lb.	.42	.55
Colors	lb.	.47	.60
Latices	lb.	.45	.61
Resin F 120	lb.	.58	.65
F242	lb.	.64	.70

Solvents

Ecostrip 57	lb.	1.50	
Enjay acetone	lb.	.085	.12
Ethyl ether	gal.	.44	
Isopropyl acetate	lb.	.115	.15
Isopropyl alcohol 91%	gal.	.42	.65
95%	gal.	.44	.67
Anhydrous	gal.	.46	.69
Isopropyl ether	gal.	.30	.51
Methyl ethyl ketone	lb.	.125	.16
Secondary butyl acetate	lb.	.1225	.1575
Secondary butyl alcohol	lb.	.125	.16

Stabilizers

Advastab B-13-P, BC-105, BC-147	lb.	.75	.80
BC-12, C-77, C-79, E-82	lb.	.90	.95
BC-74, BC-30	lb.	.70	.75
BZ-51, L paste, Z-6, Z-15	lb.	.65	.70
BZ-155	lb.	.69	.74
C-21	lb.	1.00	1.05
CH-101, CH-201	lb.	.60	.65
CZ-11	lb.	.95	1.00
E-98	lb.	.53	.58
JCX	lb.	.62	.67
SN	lb.	.47	.52
T-10, T-52	lb.	1.90	1.95
T-17M	lb.	2.95	3.00
T-50LT	lb.	3.20	3.25
T-52N	lb.	1.80	1.85
T-72, T-671	lb.	2.65	2.70
Argus Mark C	lb.	.88	.95
E	lb.	.72	.85
M	lb.	.68	.74
PL	lb.	.63	.69
TT	lb.	.72	.86
WS	lb.	.98	1.11
X	lb.	2.50	2.75
XI	lb.	.87	1.01
XV	lb.	.92	.99
XX	lb.	.58	.65
Argus Mark A	lb.	2.80	3.15
C	lb.	.81	.84
E, TT	lb.	.72	.77
GS	lb.	$0.77	$0.80
M	lb.	.59	.62
PL	lb.	.62	.65
X	lb.	2.50	2.75
XV	lb.	.84	.87
XX	lb.	.57	.60
XI	lb.	.87	.90
WS	lb.	.97	1.00
Barca 10	lb.	.75	.80
Baker barium ricinoleate	lb.	.70	
Calcium ricinoleate	lb.	.55	
Zinc ricinoleate	lb.	.60	
Dutch Boy Barinac	lb.	.70	
Calstar	lb.	.37	
Clarite A	lb.	.83	
B	lb.	.68	
CS-137	lb.	1.25	
DS-207	lb.	.55	
Dyphos	lb.	.58	.595
50A	lb.	.34	
Dythal	lb.	.395	.41
Leadstar	lb.	.39	
Lectro 60	lb.	.2525	
Normal lead maleate	lb.	.4475	
Normasal	lb.	.46	
Pearlescent pigment	lb.	1.00	
Plumb-O-Sil-A	lb.	.3075	
-B	lb.	.325	.37
-C	lb.	.3475	.375
Provinite A	lb.	.83	
B	lb.	.68	
Tribase	lb.	.275	
-E	lb.	.2225	
Trimal	lb.	.435	
Ferro 182	lb.	.70	.76
200	lb.	1.31	1.43
203, 900, 1820	lb.	.88	1.00
503	lb.	.28	.40
541A	lb.	.80	.92
700	lb.	.47	.59
703, 1972	lb.	.63	.75
823	lb.	2.50	2.75
840	lb.	3.25	
903	lb.	.58	.70
909	lb.	.91	1.01
1203	lb.	1.30	1.40
1206	lb.	1.23	1.33
1212	lb.	.68	.80
1825	lb.	.98	1.10
1840	lb.	.73	.85
1976	lb.	.45	.57
Harshaw 1-V-3	lb.	.43	.45
1-V-4	lb.	.665	.70
1-V-7, 1-V-26	lb.	.66	.68
2-V-4	lb.	.85	.87
2-V-5	lb.	1.09	1.12
5-V-1	lb.	.41	.43
7-V-2	lb.	.93	.95
8-V-1	lb.	.88	.90
8-V-21	lb.	.63	.65
8-V-100, 10-V-442	lb.	.82	.84
9-V-1	lb.	.70	.72
12-V-5	lb.	.73	.75
12-V-6	lb.	.92	.94
12-V-63	lb.	.72	.74
12-V-64	lb.	.68	.70
19-V-1	lb.	.52	.54
24-V-1	lb.	1.10	1.12
128-V-5	lb.	.86	.88
Merix AST Concentrate 1001	lb.	.355	1.75
Metasap 613-A	lb.	.69	
613-B	lb.	.84	
613-C	lb.	1.06	
621	lb.	.88	
624	lb.	.75	
Cadmium stearate	lb.	$1.40	$1.44
Fused stearates, calcium 602-A	lb.	.25	.30
Dibasic lead stearate	lb.	.55	.60
Lead 611	lb.	.32	.38
Lead stearate	lb.	.43	.47
Nuostabe V-1	lb.	.55	.60
V-2	lb.	.36	.41
V-10	lb.	.67	.80
V-12	lb.	.5525	.6825
V-14	lb.	.39	.52
V-20	lb.	1.27	1.40
V-21	lb.	1.07	1.20
V-40	lb.	1.25	1.38
V-50	lb.	.46	.59
V-60	lb.	.39	.44
V-82	lb.	2.37	2.50
V-122	lb.	.84	.91
V-130	lb.	.87	.94
V-131, V-171	lb.	.72	.79
V-132	lb.	.67	.74
V-133	lb.	.97	1.04
V-141	lb.	.57	.64
V-142	lb.	.81	.88
V-152	lb.	.62	.69
V-183	lb.	2.50	2.79
V-205	lb.	.78	1.58
Permyl A	lb.	.45	.57
Stabelan E	lb.	1.40	1.50
HR, liquid	lb.	.65	.75
Paste	lb.	.85	.95
Powder	lb.	.95	1.05
XL	lb.	.55	.65
Staflex QMXA	lb.	.70	
50% in DOP	lb.	.52	
OY	lb.	1.00	1.20
Stayrite #10	lb.	.33	.37
#15	lb.	.54	.57
#20	lb.	.38	.42
#22	lb.	1.32	1.34
#25	lb.	.36	.40
#70, 75, 80, 90	lb.	.69	.70
#229	lb.	.47	.50
P-10	lb.	.40	.44
Thermolite 12	lb.	2.00	2.25
13	lb.	3.10	3.78
15	lb.	4.13	
17	lb.	2.45	2.75
20	lb.	2.95	3.25
39	lb.	2.75	3.25
91	lb.	3.00	
Vanstay A	lb.	.51	.53
AB	lb.	.47	.49
HT	lb.	.88	.90
HTA	lb.	.98	1.00
HTB	lb.	.71	.73
HTC	lb.	1.10	1.12
L	lb.	.33	.35
R, X	lb.	.68	.70
RZ-25	lb.	.67	.69
S	lb.	.58	.60
SA	lb.	.82	.84
W	lb.	1.23	1.25
Z	lb.	.63	.65

Wetting Agents

Adawet 212	lb.	.45	.58
Merix Wash Concentrate	lb.	2.59	3.69
Nuosperse 657	lb.	.48	.56
Poly-lube No. 4	qt.	1.45	1.94

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TYPICAL PHYSICAL AND CHEMICAL PROPERTIES OF FORTIFLEX

Properties of Fortiflex "A" Related to Melt Index

PHYSICAL PROPERTIES	ASTM METHOD	UNITS	FORTIFLEX RESINS A-20	A-70	A-250	A-500
Melt Index	D-1238-52T	—	0.2	0.7	2.5	5.0
Heat Distortion Temp. (66 psi)	D-648-45T	°F.	185	185	180	180
Brittleness Temp.	D-764-52T	°F.	—200	—180	—160	—100
Impact Strength, Izod (⅛" x ½" injection-molded bars)	D-256-54T	ft. lb./in. notch	23	18	13	3
Tensile Strength, Max., 0.2 in./min.	D-638-52T	psi	3700	3600	3500	3300
Elongation, First Tensile Yield Point	D-638-52T	%	25	25	25	25

Properties of Fortiflex "A" Not Affected by Melt Index

PHYSICAL PROPERTIES	ASTM METHOD	UNITS	VALUE
Density		g/cc.	0.96
Refractive Index	D-542-50	n_D^{25}	1.54
Hardness, Shore D	D-676-49T		65
Stiffness	D-747-50	psi	150,000
Water Absorption (⅛" specimen, 24 hr. immersion @ room temp.)	D-570-54T	%, wgt. gain	<0.01
Flammability	D-635-44	in./min.	1.0
*Mold Shrinkage, length		in./in.	0.03 to 0.05
width		in./in.	0.02 to 0.04

*Measured on injection molded tensile bar. Mold shrinkage depends on part design and molding conditions.

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